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From the State Institute for Human Genetics, Uppsala, Sweden
(Head: Professor Gunnar Dahlberg, M. D., LL. D.)

# THE INCIDENCE OF CONGENITAL DISEASES AND DEFECTS IN A SOUTH SWEDISH POPULATION[1])

By J. A. BÖÖK[2]), Uppsala

Reliable figures concerning the incidence of all kinds of diseases and defects in the general population are relatively few. Still such figures are of considerable importance whether they serve more immediate practical purposes in the socio-medical field or as a basis of judgements of coincidences in the etiological field. Since the disclosure of the fact that a considerable number of clinical conditions require a specific genotypic back-ground further analyses and the checking of current theories depend to a large extent on unbiased frequency figures. These views are well recognized by geneticists working in the medical field as the comparison of disease incidences in family groups and in the general population constitutes one of the important tests. The present study which deals with congenital conditions as they have appeared at an obstetric service only, has the main scope of giving additional information about the frequencies with which some such diseases and defects may occur. Though calculated on a South Swedish population the figures should give some fairly good estimates of general interest. It should be appreciated, however, that differences may exist in comparison with other populations. Such differences may be due to different environment or different genetical compositions or combinations of both.

## *Research plan.*

The scope of the study had to be limited in accordance with the routine data available in the clinical files.

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1) The author wishes to acknowledge S. Rayner, Med. Kand., Miss Ulla Bagge, Med. Kand., and Miss Kerstin Olin, Med. Kand., for careful registration of the primary data from the files of the Division of Obstretrics, University Hospitals, Lund, Sweden (Director: Professor Alf Sjövall, M. D.).

2) Med. Lic., Fil. Lic. (Lund), Assistant Director, the State Institute for Human Genetics, Uppsala.

All congenital diseases and defects which had been diagnosed at the Division of Obstetrics, Lund University Hospitals, during the twenty-year-period 1927–46 were registered. Congenital disease is used in the sense of a condition present at births but having a progressive character. Specified congenital infectious diseases transmitted from the mother as for instance syphilis have been excluded and will not be considered in this paper. Naturally this does not exclude the possibility that an unknown number of the conditions reported here may have a maternal infectious etiology. Likewise conditions due to known isoimmunization were excluded. Congenital defect will be used synonymously with abnormality, anomaly or malformation and in the sense of a stationary condition. The congenital defects registered in this study were *not* limited to gross defects but include any deviations noted in the files, i.e. also innocuous items as for instance naevi and hemangiomata.

## *Observed data.*

During the above mentioned twenty-year-period 44,109 children were born in the clinic. Of these 1,436 were twins, thus 43,391 deliveries took place (a few triplet births being neglected). Through a study of these files 589 new-borns with diagnosed congenital disorders were discovered (or 593 if 2 monozygotic siblings of 2 thoracopagus pairs and two concordant pairs with hypospadia are included).

In particular the following data were registered:

A. As regards the index cases:

1. prenatal death – 2. live birth – 3. neonatal death (= died within a week of delivery) – 4. dismissed from the clinic alive (= survived at least one week) – 5. sex – 6. birth weight in grams – 7. total body height in centimeters – 8. twinning – 9. clinical and if available pathological description and diagnosis.

B. As regards the mother:

1. age at the birth of the index case – 2. married—unmarried.

C. As regards the sibships of the index case:

1. previous live births – 2. previous stillbirths – 3. previous abortions.

*Representativity of the data.*

Biases of all kinds are inevitably involved in any collection of clinical data and before attributing any value to conclusions drawn from such data one has to appreciate the circumstances under which each collection was obtained and if necessary make suitable corrections. In this particular case we want to know the approximate incidence of different types of congenital disorders among all births in the district of Malmöhus Län during 1927–46. This requires an unselected sample of births which is also sufficiently large.

During 1927–46 a total of 166,475 children were born in the district which averages a population of half a million. The sample of 44,109 new-borns selected for the present study thus is about 26 per cent of the total. It should be sufficiently large to include most varieties of congenital disorders even if naturally some very rare types might be missed.

The sample is a clinical population which is always a good reason to be suspicious. Quite a few congenital disorders are correlated with a more or less abnormal pregnancy, notably a tendency to abortion and hydramnion. Therefore, if relatively few births, only, take place in institutions one might anticipate an overrepresentation of such cases and consequently also of congenital disorders.

Table 1 shows that the incidence of institutional births in Malmöhus Län increased from 45 to practically 100 per cent from 1927 to 1946. For the whole period the average incidence was 79 per cent. Also the increase ran parallel with the increased number of wards available. Furthermore, the sex ratio of the total births and that of the sample are exactly the same, namely 106 ♂ : 100 ♀ (tables 1 and 2), whereas the sex ratio of the cases with congenital disorders was as high as 120 ♂ : 100 ♀. The University Hospital at Lund was chosen except for the obvious reason of being a research center also because it serves a medium sized town of 30,000 as well as a relatively large countryside.

Thus it would seem that the present sample safely could be considered representative of the total population of 166,475 births of the period 1927–46.

*General survey.*

The diagnoses of the 589 cases correspond to generally recognized clinical standards and have, with very few exceptions, been accepted

*Table 1.* Relation of births which have occurred in institutions and in private homes during 1927–1946 in the district of Malmöhus Län, Sweden. Inclusive of stillbirths.

| Year | Total number of births Boys | Girls | Number of births in institutions | Percentage institutional births |
|---|---|---|---|---|
| 1927 | 4199 | 3898 | 3616 | 45 |
| 1928 | 4213 | 3894 | 4462 | 55 |
| 1929 | 3911 | 3754 | 3855 | 50 |
| 1930 | 3965 | 3866 | 4292 | 55 |
| 1931 | 3811 | 3554 | 4271 | 58 |
| 1932 | 3691 | 3572 | 4278 | 59 |
| 1933 | 3552 | 3253 | 4244 | 62 |
| 1934 | 3608 | 3502 | 4604 | 65 |
| 1935 | 3535 | 3332 | 5267 | 77 |
| 1936 | 3740 | 3539 | 5885 | 81 |
| 1937 | 3947 | 3727 | 6535 | 85 |
| 1938 | 3987 | 3813 | 6965 | 89 |
| 1939 | 4088 | 3893 | 7440 | 93 |
| 1940 | 4102 | 3977 | 7419 | 92 |
| 1941 | 4237 | 3959 | 7777 | 95 |
| 1942 | 4930 | 4548 | 9105 | 96 |
| 1943 | 5348 | 4954 | 9957 | 97 |
| 1944 | 5607 | 5312 | 10667 | 98 |
| 1945 | 5738 | 5235 | 10952 | 100 |
| 1946 | 5501 | 5183 | 10600 | 99 |
| Totals | 166.475 | | 132.191 | 79 |

*Sex ratio*, ♂ : ♀, 106 : 100.

as they appeared in the files. In cases with two or more diagnoses the most severe condition (in direct relation to viability) was selected as main diagnosis. When not otherwise stated the tables have been arranged according to these main diagnoses, each diagnosis representing one case.

The recorded 589 cases thus may be considered as a fairly complete registration of congenital diseases and defects really existing in the present body of 44,109 births. The statement, of course, must be qualified by emphasizing that such anomalies only which were recognized clinically immediately at birth or within a week of birth have been included.

As concerns the statistical estimate of the incidence of different types of anomalies one must realize that different diagnoses have a

*Table 2.* Total births at the Division of Obstetrics, Lund University Hospitals during 1927–1946 inclusive.

| | Number | Percentage |
|---|---|---|
| Live births | | |
| *at term* . . . . . . . . . . . . . . | 40.646 | 92.1 |
| *premature* . . . . . . . . . . . . . | 2.459 | 5.6 |
| Stillbirths | | |
| *at term* . . . . . . . . . . . . . . | 648 | 1.5 |
| *premature* . . . . . . . . . . . . . | 356 | 0.8 |
| Total births . . . . . . . . . . . . . | 44.109 | (22.712 ♂ and 21.397 ♀) |
| Total deliveries . . . . . . . . . . . | 43.391 | |

*Sex ratio*, ♂ : ♀, 106 : 100. – *Twin births* 718 or 1.7 $\pm$ 0.06 per cent.

different observational value. Some conditions which cannot reasonably have been missed, like anencephaly, harelip and cleft palate because they can easily be directly observed or like atresia of oesophagus, rectum or duodenum because they very soon give alarming clinical symptoms, have a high observational value. For other conditions the observational value has been considered more or less dubious but the calculated incidence figures have nevertheless been given.

Naturally, no claim is made that the diagnostic items represent anything but semantic entities. Some conditions, however, as chondrodystrophy, harelip (and cleft palate) and club-feet according to previous studies come more or less close to etiological entities which gives more significance to the incidence figures.

Table 2 shows the incidence of stillbirths and prematurity in the present sample. These figures, of course, add nothing to what can be read in the Swedish official statistics. The incidence of stillbirths from all causes amounting to 2.3 $\pm$ 0.07 per cent is in agreement with the over all average incidence for the country during the same period (2.5 $\pm$ 0.02 per cent). Small differences, only, occur between different geographical regions. A slightly higher and significant (3.0 to 2.8 per cent) difference was found in certain northern regions. This is very likely due to the fact that the population here still gets less medical attention and a much higher proportion of the deliveries occur in the homes.

It is noteworthy that of the 1,004 stillbirths reported here 46 only had been recognized as having some specific congenital disease

or defect. Thus more than 95 per cent displayed at least no gross external malformation.

The possibilities of estimating the actual incidence of gross external malformations seem somewhat restricted as we do not know to what extent these may cause foetal death very early. In other words gross external malformations observable in an obstetric service may represent part, only, of the same malformations disappearing as unrecognized abortions. As concerns anencephaly this has been discussed by the writer earlier (*Böök* and *Rayner* [1950]) but it may be equally valid for other conditions.

At present it would therefore seem that external malformations of slight or medium severity (i. e. not too low survival value) which are easily detected are the only ones for which something like reliable frequency figures can be estimated. This, however, should by no means deprive the calculated incidence figures for other conditions of any value. They may still be useful for comparison but it has to be kept in mind that they may be far away from the real figures. The frequency figures reported in this paper, furthermore, should be valuable as purely empirical average risk figures for different congenital disorders.

*Table 3.* Distribution of malformations on different organ systems in the 589 cases of the present study.

| Group | Observed no. | Per cent of total |
|---|---|---|
| A. Nervous | 105 | 17.8 |
| B. Gastro-intestinal | 38 | 6.5 |
| C. Bones, muscles, skin | 302 | 51.3 |
| D. Cardio-vascular | 47 | 8.0 |
| E. Monsters | 8 | 1.4 |
| F. Genito-urinary | 48 | 8.1 |
| G. Respiratory | 3 | 0.5 |
| H. Other types | 38 | 6.4 |
| Total | 589 | 100.0 |

The distribution of the different congenital lesions on some different organ systems is shown in table 3. Mostly the emphasis has been laid on the majority of cases belonging to the "Nervous" group (*Murphy* [1947], *Record* and *McKeown* [1949]). This is true when the index cases are collected from death records but this procedure gives one side of the picture, only. Beyond any doubt defects of the

central nervous system are responsible for most deaths due to congenital malformations (cf. table 4). This, however, should not obscure the fact that other organ systems are affected more often, let be with less disastrous results.

*Table 4.* A survey of the incidence of stillbirth and neonatal death (589 cases of the present study).

| Group[1] | I Stillborn M | F | Total[2] | II Neonatal death M | F | Total[2] | III Dismissed from hosp. M | F | Total[2] | Total I + II + III M | F | △[3] | Total[2] | Mortality No. | % of group | I+II % of total No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 11 | 13 | 27 | 19 | 27 | 47 | 12 | 19 | 31 | 42 | 59 | 4 | 105 | 74 | 70 | 42.6 |
| B | 0 | 0 | 0 | 10 | 10 | 20 | 13 | 5 | 18 | 23 | 15 | 0 | 38 | 20 | 53 | 11.5 |
| C | 6 | 1 | 8 | 10 | 8 | 19 | 149 | 123 | 275 | 165 | 132 | 5 | 302 | 27 | 9 | 15.5 |
| D | 1 | 1 | 2 | 10 | 7 | 17 | 17 | 11 | 28 | 28 | 19 | 0 | 47 | 19 | 40 | 10.9 |
| E | 1 | 2 | 5 | 1 | 1 | 3 | 0 | 0 | 0 | 2 | 3 | 3 | 8 | 8 | 100 | 4.6 |
| F | 1 | 1 | 2 | 2 | 3 | 5 | 37 | 4 | 41 | 40 | 8 | 0 | 48 | 7 | 15 | 4.0 |
| G | 0 | 1 | 1 | 2 | 0 | 2 | 0 | 0 | 0 | 2 | 1 | 0 | 3 | 3 | 100 | 1.7 |
| H | 0 | 1 | 1 | 8 | 7 | 15 | 5 | 17 | 22 | 13 | 25 | 0 | 38 | 16 | 42 | 9.2 |
| $\Sigma\Sigma$ | 20 | 20 | 46 | 62 | 63 | 128 | 233 | 179 | 415 | 315 | 262 | 12 | 589 | 174 | 30 | 100.0 |
| % of all 589 | | | | | | | | | | | | | | | | |
| | 3.4 | 3.4 | 7.8 | 10.5 | 10.7 | 21.7 | 39.6 | 30.4 | 70.5 | 53.5 | 44.5 | 2.0 | 100 | | | |

[1]) Group A Nervous
Group B Gastro-intestinal
Group C Bones, muscles, skin
Group D Cardio-vascular
Group E Monsters
Group F Genito-urinary
Group G Respiratory
Group H Other types

[2]) Including unknown sex

[3]) Unknown sex

Some further characteristics of this population of congenital diseases and defects have been computed in table 4. The uncertainty connected with the different observational value of different conditions has already been emphasized and the data do not invite to much speculation.

## *Observed frequencies of specific disorders.*

The main results of this study have been summarized in tables 5 and 6. Exclusive of the diseases and defects mentioned in these tables one case each of the following main diagnoses was observed:

Amputation of feet, Amyotonia congenita, Aplasia of radius, Atresia of jejunum, Coloboma iridis, Cranial defect unspecified, Cranial dysplasia, Cysta colli lateralis, Cysta funiculi umbilicalis, Cysta subcutanea thoracis, Fibrochondroma, Genu recurvatum, Hydrops, Hymenal cyst, Hyphemia oculi, Hypoplasia of nasal

bone, Hypoplasia of radius, Hypoplasia of radius and ulna, Hypoplasia of right arm, Intestinal malformation not specified, Lipoidosis, Malformation of calcaneus, Malformation of cornea, Malformation of feet not specified, Malformation of forearm and hand not specified, Malformation of liver, Malformation of lung lobe, Malformation of trachea and oesophagus, Malformation not specified, Manus vara, Meningeoma, Misshaped toes, Myelogenic leukemia, Osteogenesis imperfecta, Papilloma, Pararectal tumour, Polycystic lungs, Polypus ani, Polypus vaginae, Preputium fissum, Renal malformation, Situs inversus, Spina bifida occulta, Stenosis arteriae pulmonalis, Stenosis of colon, Strictura urethrae, Talipes adductus, Talipes supinatus, Ulcus duodeni, Vaginal hemorrhage and Volvulus intestinalis.

These odd cases make a total of 55.

Tables 5 and 6 contain cases or diagnostic items which were represented at least twice. Standard errors are given when at least

*Table 5.* Observed frequencies of some congenital diseases and defects based on a survey of 44,109 total births at the Division of Obstetrics, Lund University Hospitals, during 1927–1946. Referring to the discussion in the text the diagnoses have been printed with capital letters when the incidence figure was considered to be a good or fair estimate of the true frequency, with italics for conditions with high observational value.

| Main diagnoses — Number of births: | Males 22.712 No. | Males Per 10.000 | Females 21.397 No. | Females Per 10.000 | Total 44.109 No.[1] | Total Per 10.000 |
|---|---|---|---|---|---|---|
| *Anencephaly* | 9 | 4.0±1.3 | 15 | 7.1±1.8 | 24 | 5.4±1.1 |
| *Ankylosis of finger joints* | 0 | | 1 | | 2 | 0.5 |
| Atheroma | 1 | | 1 | | 2 | 0.5 |
| *Atresia ani and / or recti* | 12 | 5.3±1.5 | 5 | 2.3 | 17 | 3.9±0.9 |
| *Atresia duodeni* | 2 | 0.9 | 3 | 1.4 | 5 | 1.0 |
| ATRESIA MEATUS ACUSTICUS EXTERNUS | 2 | 0.9 | 0 | | 2 | 0.5 |
| *Atresia oesophagi* | 2 | 0.9 | 2 | 0.9 | 4 | 0.9 |
| *Atresia of ureters* | 1 | | 2 | 0.9 | 3 | 0.7 |
| *Atresia urethrae* | 2 | 0.9 | 0 | | 2 | 0.5 |
| CHEILO-GNATHO-PALATOSCHISIS GROUP | | | | | | |
| 1. HARELIP OR HARELIP+CLEFT PALATE | *47* | *20.7±3.0* | *11* | *5.1±1.5* | *59* | *13.4±1.7* |
| a) CHEILO-GNATHO-PALATOSCHISIS | 33 | 14.5±2.5 | 8 | 3.7 | 42 | 9.5±1.5 |
| b) CHEILO-GNATHOSCHISIS | 3 | 1.3 | 0 | | 3 | 0.6 |
| c) CHEILOSCHISIS | 11 | 4.8±1.5 | 3 | 1.4 | 14 | 3.2±0.9 |
| 2. ISOLATED PALATOSCHISIS | 5 | 2.2 | 11 | 5.1±1.5 | 16 | 3.6±0.9 |
| *Chondrodystrophy* | 3 | 1.3 | 3 | 1.4 | 7 | 1.6 |
| Congenital heart diseases | 20 | 9.8±2.1 | 9 | 4.2±1.4 | 29 | 6.6±0.9 |
| *Ectopia vesicae urinariae* | 1 | | 1 | | 2 | 0.5 |
| ECTRODACTYLISM | 1 | | 2 | 0.9 | 3 | 0.7 |
| *Encephalocele* | 2 | 0.9 | 0 | | 2 | 0.5 |
| | 110 | | 76 | | 159 | |

| Main diagnoses / Number of births: | Males 22.712 No. | Per 10.000 | Females 21.397 No. | Per 10.000 | Total 44.109 No.[1] | Per 10.000 |
|---|---|---|---|---|---|---|
| | 110 | | 76 | | 159 | |
| EPIDERMIOLYSIS BULLOSA CONGENITA | 0 | | 2 | 0.9 | 2 | 0.5 |
| Fibroma | 3 | 1.3 | 3 | 1.4 | 6 | 1.4 |
| Fistula ad anum | 2 | 0.9 | 0 | | 2 | 0.5 |
| Fistula oesophago-thraceale | 2 | 0.9 | 0 | | 2 | 0.5 |
| HEMANGIOMA | 7 | 3.1 | 9 | 4.2±1.4 | 16 | 3.6±0.9 |
| Hemorrhagia suprarenalis | 2 | 0.9 | 2 | 0.9 | 4 | 0.9 |
| Hemorrhagic diathesis | 1 | | 1 | | 2 | 0.5 |
| Hernia diaphragmatica | 3 | 1.3 | 2 | 0.9 | 5 | 1.0 |
| Hernia inguinalis | 4 | 1.8 | 0 | | 4 | 0.9 |
| Hernia umbilicalis | 3 | 1.3 | 2 | 0.9 | 5 | 1.0 |
| Hydrocele testis | 7 | 3.1 | | | 7 | |
| *Hydrocephalus* group, total | *21* | *9.2±2.0* | *19* | *8.9±2.0* | *40* | *9.0±1.4* |
| 1. *Hydrocephalus alone* | 10 | 4.4±1.4 | 7 | 3.3 | 17 | 3.9±0.9 |
| 2. *Hydrocephalus — spina bifida* | 6 | 2.6 | 10 | 4.7±1.5 | 16 | 3.6±0.9 |
| 3. *Hydrocephalus* + other defects | 5 | 2.2 | 2 | 0.9 | 7 | 1.6 |
| Hypospadia (two concordant twin pairs) | 17 | 7.5±1.8 | | | 17 | |
| *Meningocele* | 1 | | 2 | 0.9 | 3 | 0.7 |
| Microcephaly | 0 | | 7 | 3.3 | 7 | 1.6 |
| MICROPHTALMUS | 1 | | 2 | 0.9 | 3 | 0.7 |
| Mongolism | 4 | 1.8 | 16 | 7.5±1.9 | 20 | 4.5±1.0 |
| Monsters not specified | 2 | 0.9 | 3 | 1.4 | 8 | 1.8 |
| *Myelomeningocele* | 2 | 0.9 | 3 | 1.4 | 6 | 1.4 |
| Naevi | 7 | 3.1 | 8 | 3.7 | 15 | 3.4±0.9 |
| Phimosis | 6 | 2.6 | | | 6 | |
| Polycystic kidneys | 0 | | 2 | 0.9 | 2 | 0.5 |
| POLYDACTYLISM | 14 | 6.2±1.7 | 12 | 5.6±1.6 | 27 | 6.1±1.2 |
| Pseudo-hermaphroditism | | | | | 2 | 0.5 |
| *Spina bifida group*, total | *5* | *2.2* | *12* | *5.6±1.6* | *19* | *4.3±1.0* |
| 1. *Spina bifida alone* | 4 | 1.8 | 11 | 5.1±1.5 | 15 | 3.4±0.9 |
| 2. *Spina bifida*+other non-nervous defects | 1 | | 1 | | 4 | 0.9 |
| SPONTANEOUS AMPUTATION OF HAND | 0 | | 2 | 0.9 | 2 | 0.5 |
| SYNDACTYLISM | 4 | 1.8 | 2 | 0.9 | 6 | 1.4 |
| TALIPES CALCANEOVALGUS | 1 | | 5 | 2.3 | 6 | 1.4 |
| TALIPES CALCANEUS | 8 | 3.5 | 4 | 1.9 | 12 | 2.7±0.8 |
| TALIPES EQUINOVARUS | 39 | 17.2±2.7 | 26 | 12.2±2.4 | 65 | 14.7±1.8 |
| TALIPES PLANOVALGUS | 6 | 2.6 | 15 | 7.0±1.8 | 21 | 4.8±1.0 |
| TALIPES PLANUS | 1 | | 1 | | 2 | 0.5 |
| TALIPES VALGUS | 3 | 1.3 | 4 | 1.9 | 7 | 1.6 |
| Teratoma | 1 | | 0 | | 2 | 0.5 |
| THORACOPAGUS (2 pairs) | | | 2 | | 2 | 0.5 |
| Totals | 287 | | 234 | | 534 | |

[1]) Including cases of unknown sex (sex not stated in a few files).

*Table 6.* Observed frequencies of some congenital diseases and defects of the present survey according to specific diagnostic items. Compare with table 5 where main diagnoses only were included. Conditions showing the same incidence have not been repeated here.

| Diagnostic items | Males No. | Males Per 10.000 | Females No. | Females Per 10.000 | Total No.[1] | Total Per 10.000 |
|---|---|---|---|---|---|---|
| *Atresia ani and / or recti* | 14 | 6.2±1.7 | 5 | 2.3 | 19 | 4.3±1.0 |
| *Atresia oesophagi* | 4 | 1.8 | 3 | 1.4 | 7 | 1.6 |
| *Atresia of ureters* | 1 | | 3 | 1.4 | 4 | 0.9 |
| CHEILO-GNATHO-PALATOSCHISIS | | | | | | |
| 1. HARELIP OR HARELIP+CLEFT PALATE | 47 | 20.7±3.0 | 12 | 5.6±1.6 | 60 | 13.6±1.8 |
| a) CHEILO-GNATHO-PALATOSCHISIS | 33 | 14.5±2.5 | 8 | 3.7 | 42 | 9.5±1.5 |
| b) CHEILO-GNATHOSCHISIS | 3 | 1.3 | 1 | | 4 | 0.9 |
| c) CHEILOSCHISIS | 11 | 4.8±1.5 | 3 | 1.4 | 14 | 3.2±0.9 |
| 2. ISOLATED PALATOSCHISIS | 5 | 2.2 | 12 | 5.6±1.6 | 17 | 3.9±0.9 |
| Congenital heart diseases | 23 | 10.1±2.1 | 11 | 5.1±1.5 | 34 | 7.7±1.3 |
| Cryptorchidism | 6 | 2.6 | | | 6 | |
| ECTRODACTYLISM | 2 | 0.9 | 2 | 0.9 | 4 | 0.9 |
| EPISPADIA | 2 | 0.9 | | | 2 | |
| Fistula oesophago-tracheale | 3 | 1.3 | 1 | | 4 | 0.9 |
| HEMANGIOMA | 8 | 3.5 | 9 | 4.2±1.4 | 17 | 3.9±0.9 |
| Hernia umbilicalis | 3 | 1.3 | 6 | 2.8 | 9 | 2.0±0.7 |
| *Hydrocephalus* | 22 | 9.7±2.1 | 20 | 9.3±2.1 | 44 | 10.0±1.5 |
| Hydronephrosis | 3 | 1.3 | 0 | | 3 | 0.7 |
| Hypospadia | 23 | 10.1±2.1 | | | 23 | |
| *Meningocele* | 2 | 0.9 | 2 | 0.9 | 4 | 0.9 |
| MICROPHTALMUS | 1 | | 3 | 1.4 | 4 | 0.9 |
| Mongolism | 4 | 1.8 | 17 | 8.0±2.0 | 21 | 4.8±1.0 |
| *Myelomeningocele* | 5 | 2.2 | 4 | 1.9 | 10 | 2.3±0.7 |
| Phimosis | 7 | 3.1 | | | 7 | |
| Polycystic kidneys | 0 | | 3 | 1.4 | 3 | 0.7 |
| POLYDACTYLISM | 16 | 7.0±1.8 | 12 | 5.6±1.6 | 30 | 6.8±1.2 |
| Pseudo-hermaphroditism | | | | | 3 | 0.7 |
| *Spina bifida* | 16 | 7.0±1.8 | 27 | 12.6±2.4 | 47 | 10.7±1.6 |
| SYNDACTYLISM | 8 | 3.5 | 3 | 1.4 | 11 | 2.5±0.8 |
| TALIPES CALCANEOVALGUS | 1 | | 5 | 2.3 | 7 | 1.6 |
| TALIPES EQUINOVARUS | 47 | 20.7±3.0 | 30 | 14.0±2.6 | 78 | 17.7±2.0 |
| TALIPES PLANOVALGUS | 10 | 4.4±1.4 | 15 | 7.0±1.8 | 25 | 5.7±1.1 |
| TALIPES PLANUS | 1 | | 2 | 0.9 | 3 | 0.7 |
| TALIPES VALGUS | 3 | 1.3 | 5 | 2.3 | 8 | 1.8 |
| Teleangiectasia | 2 | 0.9 | 0 | | 2 | 0.5 |
| Uterus bicornis or duplex | | | 4 | 1.9 | 4 | |

[1]) Including cases of unknown sex (sex not stated in a few files).

9 cases have been observed. For less than 9 cases the standard error has not much meaning. As concerns the interpretation of the incidence figures reference is made to the qualifications given above.

The total malformation risk is 1.3 $\pm$ 0.05 per cent per individual. *Miller* [1950] in a smaller survey of 4,095 consecutive births from Kansas Medical Center reported 1.6 per cent (exclusive of maternal syphilis, diabetes or isoimmunisation). The defects of the central nervous system alone amounted to 27 : 62 or about 44 per cent.

## *Maternal characteristics.*

### *Maternal age.*

In table 7 the age of the mothers when the malformed child was born has been compared with the maternal age distribution of the total population of births of the whole district during the same period of years. Children born intra- and extra-matrimonially were scored separately. When all cases are grouped together a tendency towards overrepresentation of the older age groups is obvious among the married women.

When corresponding calculations were made for the different groups A–H (cf tables 8–13) the differences were found to be especially pronounced for group F (genito-urinary) and H (miscellaneous conditions). The explanation for group H is simply that of the 32 cases here no less than 18 are mongoloid idiots. This relation between mongolism and increased maternal age has since long been an

*Table 7.* Statistical analysis of maternal age as compared with the total population in table 1.

Groups A–H.

| Born intramatrimonially | | | Born extramatrimonially | | |
|---|---|---|---|---|---|
| Age of mother, years | Observed | Expected | Age of mother, years | Observed | Expected |
| 15–25 | 108 | 123.71 | 15–20 | 27 | 22.82 |
| 25–30 | 139 | 158.38 | 20–25 | 39 | 35.42 |
| 30–35 | 140 | 126.04 | 25–30 | 11 | 13.45 |
| 35–50 | 120 | 98.87 | 30–40 | 4 | 9.31 |
| Total | 507[1]) | 507.00 | Total | 81 | 81.00 |
| $\chi^2 = 10.43$ | $n = 3$ | $P = 0.016$ | $\chi^2 = 4.60$ | $n = 3$ | $P = 0.21$ |

[1]) Age not stated for one mother.

*Table 8.* Statistical analysis of maternal age.

Group A (nervous).

| Born intramatrimonially | | | Born extramatrimonially | | |
|---|---|---|---|---|---|
| Age of mother, years | Observed | Expected | Age of mother, years | Observed | Expected |
| 15–25 | 18 | 20.59 | 15–20 | 5 | 5.92 |
| 25–30 | 23 | 26.35 | 20–25 | 10 | 9.18 |
| 30–35 | 22 | 20.97 | 25–40 | 6 | 5.90 |
| 35–45 | 21 | 16.09 | | | |
| Total | 84 | 84.00 | Total | 21 | 21.00 |
| $\chi^2 = 2.30$ | $n = 3$ | $P = 0.52$ | $\chi^2 = 0.22$ | $n = 2$ | |

*Table 9.* Statistical analysis of maternal age.

Group B (gastro-intestinal).

| Born intramatrimonially | | | Born extramatrimonially | | |
|---|---|---|---|---|---|
| Age of mother, years | Observed | Expected | Age of mother, years | Observed | Expected |
| 15–25 | 6 | 8.76 | 15–20 | 2 | 1.27 |
| 25–30 | 9 | 11.21 | 20–25 | 1 | 1.98 |
| 30–35 | 10 | 8.93 | 25–30 | 1 | 0.75 |
| 35–40 | 9 | 5.10 | | | |
| Total | 34 | 34.00 | Total | 4 | 4.00 |
| $\chi^2 = 4.42$ | $n = 3$ | $P = 0.22$ | | | |

*Table 10.* Statistical analysis of maternal age.

Group C (bones, muscles, skin).

| Born intramatrimonially | | | Born extramatrimonially | | |
|---|---|---|---|---|---|
| Age of mother, years | Observed | Expected | Age of mother, years | Observed | Expected |
| 15–25 | 61 | 64.66 | 15–20 | 12 | 10.42 |
| 25–30 | 76 | 82.78 | 20–25 | 18 | 16.19 |
| 30–35 | 78 | 65.88 | 25–40 | 7 | 10.39 |
| 35–50 | 50 | 51.68 | | | 37.00 |
| Total | 265 | 265.00 | Total | 37 | |
| $\chi^2 = 3.05$ | $n = 3$ | $P = 0.39$ | $\chi^2 = 1.55$ | $n = 2.$ | $P = 0.48$ |

*Table 11.* Statistical analysis of maternal age.

Group D (cardio-vascular).

| Born intramatrimonially | | | Born extramatrimonially | | |
|---|---|---|---|---|---|
| Age of mother, years | Observed | Expected | Age of mother, years | Observed | Expected |
| 15–25 | 9 | 9.80 | 15–20 | 4 | 2.74 |
| 25–30 | 15 | 12.56 | 20–25 | 3 | 4.26 |
| 30–35 | 9 | 9.98 | | | |
| 35–45 | 7 | 7.66 | | | |
| Total | 40 | 40.00 | Total | 7 | 7.00 |

$\chi^2 = 0.69$ $n = 3$

*Table 12.* Statistical analysis of maternal age.

Group F (genito-urinary).

| Born intramatrimonially | | | Born extramatrimonially | | |
|---|---|---|---|---|---|
| Age of mother, years | Observed | Expected | Age of mother, years | Observed | Expected |
| 15–25 | 6 | 10.54 | 15–20 | 2 | 1.57 |
| 25–30 | 10 | 13.49 | 20–25 | 2 | 2.43 |
| 30–35 | 10 | 10.73 | | | |
| 35–45 | 17 | 8.24 | | | |
| Total | 43 | 43.00 | Total | 4 | 4.00 |

$\chi^2 = 12.22$ $n = 3$ $P = 0.0068$

*Table 13.* Statistical analysis of maternal age.

Group H (other types).

| Born intramatrimonially | | | Born extramatrimonially | | |
|---|---|---|---|---|---|
| Age of mother, years | Observed | Expected | Age of mother, years | Observed | Expected |
| 15–25 | 6 | 7.84 | 15–20 | 2 | 1.91 |
| 25–35 | 12 | 18.03 | 20–25 | 3 | 2.96 |
| 35–45 | 14 | 6.13 | 25–30 | 1 | 1.13 |
| Total | 32 | 32.00 | Total | 6 | 6.00 |

$\chi^2 = 12.55$ $n = 2$ $P = 0.0019$

*Table 14.* Statistical analysis of maternal age. Specified conditions.

| Age of mother, years | Born intramatrimonially Observed | Expected | $\chi^2$ | n | P | Born extramatrimonially Age of mother, years | Observed | Expected |
|---|---|---|---|---|---|---|---|---|
| *Atresia ani and/or recti* | | | | | | | | |
| 20–30 | 6 | 9.23 | | | | 15–20 | 1 | |
| 30–40 | 10 | 6.77 | | | | | | |
| Total | 16 | 16.00 | 2.67 | 1 | $0.20 < P < 0.10$ | Total | 1 | |
| *Cheilo-Gnatho-Palatoschisis group:* | | | | | | | | |
| 15–25 | 14 | 12.26 | | | | 15–20 | 4 | 3.53 |
| 25–30 | 17 | 15.68 | | | | 20–25 | 5 | 5.47 |
| 30–35 | 7 | 12.48 | | | | | | |
| 35–45 | 12 | 9.58 | | | | | | |
| Total | 50 | 50.00 | 3.37 | 3 | $0.50 < P < 0.30$ | Total | 9 | 9.00 |
| *Congenital heart disease:* | | | | | | | | |
| 20–25 | 5 | 5.42 | | | | 15–20 | 4 | 1.96 |
| 25–30 | 9 | 7.72 | | | | 20–25 | 1 | 3.04 |
| 30–45 | 10 | 10.86 | | | | | | |
| Total | 24 | 24.00 | 0.31 | 2 | $0.90 < P < 0.80$ | Total | 5 | 5.00 |
| *Hydrocephalus group, total:* | | | | | | | | |
| 15–25 | 5 | 7.60 | | | | 15–20 | 1 | 2.86 |
| 25–30 | 9 | 9.72 | | | | 20–25 | 3 | 4.55 |
| 30–35 | 8 | 7.74 | | | | 25–30 | 5 | 1.69 |
| 35–45 | 9 | 5.94 | | | | | | |
| Total | 31 | 31.00 | 2.53 | 3 | $0.50 < P < 0.30$ | Total | 9 | 9.00 |
| *Hypospadia:* | | | | | | | | |
| 20–30 | 9 | 8.76 | | | | 20–25 | 1 | |
| 30–45 | 7 | 7.24 | | | | | | |
| Total | 16 | 16.00 | 0.01 | 1 | | Total | 1 | |
| *Mongolism:* | | | | | | | | |
| 20–35 | 8 | 14.40 | | | | 20–25 | 2 | |
| 35–50 | 10 | 3.60 | | | | | | |
| Total | 18 | 18.00 | 14.22 | 1 | $< 0.001$ | Total | 2 | |
| *Palatoschisis alone:* | | | | | | | | |
| 15–30 | 6 | 8.81 | | | | 20–25 | 1 | |
| 30–40 | 9 | 6.19 | | | | | | |
| Total | 15 | 15.00 | 2.17 | 1 | $0.20 < P < 0.10$ | Total | 1 | |

*Table 14* (continued).

| Age of mother, years | Born intramatrimonially Observed | Expected | $\chi^2$ | n | P | Born extramatrimonially Age of mother, years | Observed | Expected |
|---|---|---|---|---|---|---|---|---|
| *Polydactylism:* | | | | | | | | |
| 15–25 | 6 | 6.13 | | | | 15–20 | 1 | 0.78 |
| 25–30 | 7 | 7.84 | | | | 20–25 | 1 | 1.22 |
| 30–45 | 12 | 11.03 | | | | | | |
| Total | 25 | 25.00 | 0.18 | 2 | $0.95 < P < 0.90$ | Total | 2 | 2.00 |
| *Spina bifida group, total:* | | | | | | | | |
| 20–25 | 6 | 3.39 | | | | 15–20 | 2 | 1.57 |
| 25–45 | 9 | 11.61 | | | | 20–25 | 2 | 2.43 |
| Total | 15 | 15.00 | 2.60 | 1 | $0.20 < P < 0.10$ | Total | 4 | 4.00 |
| *Talipes equinovarus:* | | | | | | | | |
| 15–25 | 16 | 13.66 | | | | 15–20 | 3 | 2.54 |
| 25–30 | 17 | 17.50 | | | | 20–25 | 4 | 3.93 |
| 30–35 | 11 | 13.92 | | | | 25–40 | 2 | 2.53 |
| 35–50 | 12 | 10.92 | | | | | | |
| Total | 56 | 56.00 | 1.13 | 3 | $0.80 < P < 0.70$ | Total | 9 | 9.00 |

established fact (cf. *Benda* [1949]). In table 14 the maternal age has been analyzed for a number of conditions which were represented by a reasonable number of cases. None of these conditions except mongolism show significant deviations from the expected figures. A detailed analysis of maternal age as concerns anencephalic index cases has been reported previously (*Böök* and *Rayner* [1950]). Also for these the result was negative.

### *Illegitimacy.*

Civil state was reported for 588 mothers. Of these 81 were single when the index cases were born, i.e. 13.8 per cent. The average illegitimacy rate of the district was 14.5 per cent (based on a total of 164.032). The difference according to a chi-square test is not significant. However, a tendency to a lower rate for women who give birth to congenitally defective children could be anticipated as the maternal age is slightly increased for this group and the illegitimacy rate decreases with increasing maternal age.

*Development of malformed children at birth.*

To differentiate between prematurity and full term development the weight and length taken immediately after birth were used. As concerns weight 2,500 g and length 47 cm constitute the dividing lines. The observed distribution is shown in table 15. The index

*Table 15.* Development of the malformed children of the present study according to weight and length at birth.

| Weight, g | No. | Per cent | Length, cm | No. | Per cent |
|---|---|---|---|---|---|
| 500–1000 | 4 | 0.7 | 22–27 | 1 | 0.2 |
| 1000–1500 | 12 | 2.1 | 27–32 | 3 | 0.5 |
| 1500–2000 | 25 | 4.3 | 32–37 | 10 | 1.7 |
| 2000–2500 | 40 | 6.9 | 37–42 | 22 | 3.8 |
| 2500–3000 | 91 | 15.7 | 42–47 | 63 | 11.0 |
| 3000–3500 | 190 | 32.8 | 47–52 | 350 | 60.9 |
| 3500–4000 | 135 | 23.3 | 52–57 | 123 | 21.4 |
| $\geq$4000 | 82 | 14.2 | $\geq$57 | 3 | 0.5 |
| Total | 579 | 100.0 | Total | 575 | 100.0 |
| Males | 310 | 53.5 | Males | 308 | 53.6 |
| Females | 260 | 44.9 | Females | 260 | 45.2 |
| Unknown sex | 9 | 1.6 | Unknown sex | 7 | 1.2 |
| $M \pm \varepsilon(M)$ | $3253.5 \pm 30.9$ g | | $M \pm \varepsilon(M)$ | $49.28 \pm 0.17$ cm | |
| $\sigma$ | 744.5 g | | $\sigma$ | 4.17 cm | |

cases were born prematurely about 3 times as often as children with no such diagnoses. A chi-square test showed that this difference is statistically significant ($P < 0.001$ for both items). A detailed analysis showed that this tendency towards prematurity prevails in all groups A–H, being somewhat more pronounced, only, for group A (Nervous).

These findings are in good agreement with *Murphy*'s observations [1947]. The only reasonable explanation is that the pathology of the foetus upsets the normal relationship between the foetus and the mother with a tendency to shorten the pregnancy as result. As the majority of the diseases and defects reported here can be referred to pathological processes which take their beginning during very early developmental stages there seems to be no reason anticipating any kind of cause or effect of the prematurity as such.

*Sibship data.*

As mentioned above information was obtained about the outcome of pregnancies which occurred previous to the births of the malformed index cases. Thus mostly incomplete families are included. Nevertheless it should be of some interest to study the outcome of these pregnancies in terms of abortions, stillbirths and live births. Those are namely the only items of which reliable information was obtained. The 589 index cases had together 916 previous sib-pregnancies of which 115 ended with abortion or stillbirth making a total lethal outcome of about 12.6 per cent. In table 16 these figures

*Table 16.* Lethal outcome of pregnancies previous to the index case for mothers of malformed children in the present material, compared with corresponding pregnancies of 1,400 mothers of normal index cases selected by file number covering the period 1925 to 1945 at the Division of Obstetrics, University Clinics of Lund.

| Pregnancies with known outcome | Abortions and stillbirths (lethal) | Born alive (non-lethal) | Total |
|---|---|---|---|
| Malformed children 589 | 115 | 801 | 916 |
| Normal propositus 1400 | 265 | 3289 | 3554 |

$\chi^2 = 34.4 \quad n = 1 \quad P < 0.001$

have been scored against the outcome of 3,554 sib-pregnancies which occurred previous to the births of 1,400 normal index cases. These normal children were born during 1925–1945 in the same clinic. Lethal outcome of the sib-pregnancies was found in about 7.5 per cent. From a statistical point of view the difference is highly significant.

Though incomplete and not suitable for a closer analysis these findings reflect one aspect of a repeat tendency in families where one malformed child has occurred. One might speak of a tendency measured in term of viability, only. More conclusive evidence of a higher repeat rate among sibs has been given by *Murphy* [1947]. Complete families were studied and the repeats amounted to 11.2 per cent (including all kind of malformations, live and still but not abortions). *Murphy* concluded this figure to be approximately 24 times greater than the rate in the general population as compared with data collected by himself.

An analysis of the present data group by group showed that an increased incidence of lethal outcome of previous pregnancies was

highly significant for groups A (Nervous) and C (Bones, muscles, skin) with 17.2 and 12.1 per cent respectively, whereas the six remaining groups did not show significant differences.

The only conclusion which seems justified as based on the data presented here would be that there is a much higher rate of foetal mortality in families where children with congenital diseases and defects of the central nervous system or of bones, muscles and skin are born.

*Record* and *McKeown* [1950] who studied complete families reported for CNS-malformations 15.5 per cent lethal outcome of sib pregnancies against 9.8 per cent of controls.

### *Twins.*

Of the 589 deliveries of this report resulting in the births of congenitally defective children 16 were twin births. This incidence of 1 : 37 is somewhat more than expected as out of the remaining 42.802 *deliveries* resulting in the births of children without a diagnosis of congenital disease or defect 702 only, or 1 : 61, were twin births (a few triplet births being neglected in this connection). A chi-square test between these figures gives a P-value of between 0.05 and 0.02. This might indicate that in the present data twinning as such could predispose to the birth of a defective child. However, from a practical point of view this predisposition should in any case be of minor importance, only.

Though no direct evidence was available as concerned the zygosity of the like-sexed twin pairs and the data are too limited to allow any conclusions, the 16 sets of twins will be reported briefly.

1. Male-female. Hydrocephalus – no malformation.
2. Female-female. Hydrocephalus + spina bifida – no malformation.
3. Female-male. Hydrocephalus + mongolism – no malformation.
4. Male-male. No malformation – atresia oesophagi.
5. Male-female. Diaphragmatic hernia – no malformation.
6. Male-male. Cheiloschisis – no malformation.
7. Female-female. Auricular fibroma – no malformation.
8. Female-female. Hypoplasia of nasal bone – no malformation.
9. Female-female. Talipes calcaneus – no malformation.
10. Male-female. Congenital heart defect + polydactyly – no malformation.
11. Male-female. Polydactyly – no malformation.
12. Sex not stated-sex not stated. Perineal teratoma – no malformation.
13. Male-male. Hypospadia – hypospadia.
14. Male-male. Hypospadia – hypospadia.
15. Female-female. Thoracopagus.
16. Female-female. Thoracopagus.

*Comments.*

An estimate of the incidences of congenital diseases and defects is connected with considerable difficulties and consequently open to much criticism. In evaluating the data of this report a number of qualifications, as stressed above, should be appreciated. These are likewise important if one wants to make comparisons with figures reported in other studies. Different ascertainment as to type and completeness and differences in diagnostic classification, to mention two points only, make comparisons a difficult task. These comments therefore will be restricted to a few items.

Table 17 shows a comparison of the estimated incidences of the three main types of central nervous system malformation as derived from three sources of data from different parts of the world. There is close agreement between the figures arrived at in this study and those reported by *Murphy* [1947] for Philadelphia, USA.

*Table 17.* Comparison of the incidences of the main malformations of the central nervous system as observed in this study with the reports of *Murphy* [1947] and *Record* and *McKeown* [1949]. All incidences per 10.000 total births.

| | Record and McKeown[1] Birmingham 1940–47 158.307 births | Murphy[2] Philadelphia 1929–33 166.451 births | Lund 1926–46 44.109 births |
|---|---|---|---|
| Stillbirths | 271 | | 228 |
| Anencephaly | 23 | 5 | 5 |
| Spina bifida | 16 | 6 | 4 |
| Hydrocephaly (inclusive of combinations with spina bifida) | 18 | 14 | 9 |
| Other CNS malformations | 2 | 4 | 5 |
| Total CNS malformations | 59 | 29 | 23 |

[1]) Rearranged for comparison.

[2]) Rearranged and recalculated for comparison.

On the other hand the figures of *Record* and *McKeown* [1949] for Birmingham, England, contrast rather sharply. In fact, except the figures for stillbirths, the differences between the Birmingham and Lund data are highly significant all along the line. It seems unlikely that these differences should all be due to technical inconsistencies.

To break out one item, only, the incidence of anencephaly is about 4 ½ times more frequent in Birmingham. Now anencephaly is

one of the easiest items to encounter. All cases are stillborn or die shortly after birth and it should make no difference whether the index cases are obtained via death certificates or via obstetric material. Therefore one is liable to suspect that the differences between South Sweden and England as regards the incidence of central nervous system malformations and especially anencephaly are real. This view is strengthened by the fact that *Malpas* [1937] reported 44 anencephalics out of 13.964 births in Liverpool, England. This figure of 32 : 10.000 births agrees well with the figure of *Record* and *McKeown*. The only figure of a similar magnitude found in previous reports came from *Hilesmaa* [1945]. He found an incidence of 30 : 10.000 (11.425 births studied) in the Finnish town Viipuri against 3 : 10.000 (17.084 births studied) for the capital of Finland. Otherwise the incidence figures run about 10 : 10.000 (cf. *Kemp* [1951], *Böök* and *Rayner* [1950]). Provided these figures are all correct there are two alternative explanations. Either anencephaly is a genetic disorder and gene frequencies or mutations have different values in different populations or differences in the environment cause these discrepancies. At present it is impossible to decide one way or the other. Further comparisons have been made with the Danish population which genetically should be very similar to the

*Table 18.* Comparison of the incidence of certain congenital diseases and defects as observed in this study and in the Danish population (Kemp's survey 1951).

| Disease or defect | Incidence per 100.000 births Denmark | South Sweden | |
|---|---|---|---|
| Harelip (and cleft palate) | 110 | 134 | (136) [1] |
| Isolated cleft palate | 40 | 36 | (39) [1] |
| Clubfoot | 80 | 147 | (177) [1] |
| Chondrodystrophy | 10 | 16 | |
| Osteogenesis imperfecta congenita | 2 | 2 | |
| Anencephaly | 100 | 54 | |
| Cranio-rachischisis | 100 | 107 | |
| Absence deformities of the upper extremities (including split hands and ectrodactylism, defects of radius and ulna, amputations of upper arm, forearm, hand or fingers, spontaneous amputation and exogeneous syndactyly) | 23 | 36 | |
| Hypospadia (per 100.000 males) | 300 | 75 | (101) [1] |
| Mongolism | 150 | 45 | (48) [1] |

[1]) Number of diagnoses.

population of this report. In fact the district formerly belonged to Denmark. As appears in table 18 there is fair agreement with the incidence figures so far reported for the Danish population. The higher incidence of congenital clubfoot in the present study very likely is due to the fact that milder cases or at any rate a greater number of such cases have been included here. As regards hypospadia and mongolism the ascertainment is no doubt less complete in the present study.

## *Summary and conclusions.*

1. The incidences of various types of congenital diseases and defects in a South Swedish population of about half a million people have been estimated on the basis of a sample of 44,109 consecutive births at the Division of Obstetrics, Lund University Clinics. For reasons given in the paper this sample was considered representative in respect of the scope of this study. The estimates arrived at have been summarized in tables 5 and 6. These estimates could also be used as average risk figures.

2. The total number of cases with congenital diseases and defects (exclusive of those due to known maternal infections and Rh-incompatibility) amounted to 589. All defects reported in the files including innocuous items like naevi and hemangiomata entered the registration. The over all malformation rate was 1.3 $\pm$ 0.05 per cent.

3. As causes of stillbirths and neonatal death the defects of the central nervous system range number one among all malformations. Otherwise the majority of the malformations included here concern bones, muscles and skin.

4. For all cases grouped together there was a tendency to overrepresentation of mothers belonging to older age groups. On account of a detailed analysis a significant increase of maternal age was restricted to mongolism and the group "Genito-urinary" defects.

5. Infants with congenital diseases or defects were born prematurely about 3 times as often as normal infants.

6. A much higher rate of foetal mortality (stillbirths and abortions) was found for the sib pregnancies preceding the index case, namely 12.6 per cent against 7.5 per cent for the control data. On a closer analysis it was found that this increased foetal mortality was statistically significant when the index case belonged to the groups "Nervous" (i.e. 17.2 per cent) or "Bones, muscles and skin" (i.e. 12.1 per cent) only.

*Résumé.*

1. La fréquence des types différents des maladies et des malformations congénitales dans une population du sud de la Suède d'environ un million de personnes était estimée sur la base des matériaux de 44.109 naissances consécutives dans la Clinique Obstétrique de l'Université de Lund. Pour des raisons données dans le travail la représentativité des matériaux peut être considérée comme satisfaisante au point de vue de la sphère de l'étude. Les estimations faites sont résumées dans tables 5 et 6. Ces estimations peuvent aussi être employées comme chiffres de risque.

2. Le nombre total de cas aux maladies ou malformations congénitales (exclusivement de ceux qui venaient de maladies contagieuses de la mère et de Rh-incompatibilité) s'élevait à 589. Toutes les malformations figurantes dans les journaux de l'hôpital y compris des affections innocentes comme naevi et hemangiomata étaient régistrées. La fréquence totale de malformations était $1,3 \pm 0,05$ %.

3. Parmi les malformations des affections du système nerveux central sont le plus souvent la cause des cas de morts-nés et des décès de nouveaux-nés. La majorité des autres malformations traitées ici intéressent les os, les muscles et la peau.

4. Pour l'ensemble des cas il y avait une fréquence élevée des mères plus âgées. A une analyse détaillée il s'est montré qu'une augmentation significative de l'âge de la mère pouvait être établie seulement pour mongolisme et pour les affections génito-urinaires.

5. Les enfants aux maladies ou affections congénitales étaient nés avant terme environ trois fois plus souvent que les enfants normaux.

6. Il était trouvé que la mortalité des fœtus parmi les grossesses précédant le cas d'index était beaucoup plus haute que celle parmi les cas témoins, à savoir 12.6 % et 7.5 % respectivement. Une analyse détaillée montrait que cette mortalité augmentée des fœtus était significative, quand les cas d'index appartenaient seulement au groupe „Nerveux" (notamment 17.2 %) ou au groupe „Os, muscles et peau" (notamment 12.1 %).

*Zusammenfassung.*

1. Das Auftreten von verschiedenen Arten von angeborenen Krankheiten und Defekten bei einer südschwedischen Bevölkerung von rund einer Million Menschen ist auf der Basis von einem Material

von 44.109 aufeinanderfolgenden Geburten auf der obstetrischen Station der Universitätsklinik in Lund geschätzt worden. Aus Gründen, welche in der Arbeit angeführt werden, kann das Material in bezug auf das Problem, auf welches die Untersuchung abzielt, als representativ angesehen werden. Die erhaltenen Schätzungen finden sich in den Tabellen 5 und 6. Diese Schätzungen können auch als durchschnittliche Risikoziffern benutzt werden.

2. Die totale Anzahl Fälle mit angeborenen Krankheiten und Defekten (ausgenommen diejenigen, welche auf bekannten Infektionen bei der Mutter oder Rh-inkompatibilität beruhen) betrug 589. Alle Defekte, welche sich in den Journalen aufgezeichnet fanden, einschließlich unschuldiger Leiden wie Naevi und Hemangiomata, wurden registriert. Die totale Mißbildungsfrequenz war 1,3 ± 0,05 %.

3. Als Ursachen für Totgeburten und Todesfälle bei Neugeborenen rangieren Defekte des zentralen Nervensystems als Nummer eins unter den Mißbildungen. Im übrigen bezieht sich der Hauptteil der hier eingeschlossenen Mißbildungen auf Knochen, Muskeln und Haut.

4. Für alle Fälle zusammengenommen lag eine Tendenz zu einer höheren Frequenz von Müttern, welche den älteren Altersgruppen angehörten, vor. Bei Detailanalyse zeigte es sich, daß eine sichergestellte Erhöhung des Alters der Mutter nur bei Mongolismus und der Gruppe der Genital-Urinwegdefekte vorlag.

5. Kinder mit angeborenen Krankheiten oder Defekten wurden ungefähr dreimal so oft zu früh geboren als normale Kinder.

6. Eine viel höhere Fötalsterblichkeit (Totgeburten und Aborte) wurde unter den Schwangerschaften festgestellt, welche den Indexfällen vorausgingen, nämlich 12.6 % gegenüber 7.5 % für die Kontrollfälle. Bei näherer Analyse zeigte es sich, daß diese gesteigerte Sterblichkeit statistisch sichergestellt war, wenn die Indexfälle nur den Gruppen „Nervöse" (nämlich 17.2 %) oder „Knochen, Muskeln und Haut" (nämlich 12,1 %) angehörten.

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# CONGENITAL MALFORMATION OF THE NAILS ASSOCIATED WITH DEFORMITIES OF THE ELBOWS AND KNEES

(Monozygotic Twins.)

By JOHANNES MOSBECH, Copenhagen.

Among the rare congenital deformities of the nails (onychoses) onychatrophy is of relatively common occurrence (*Kemp* and *Andersen*). The deformity is reported to have been concordant in twins (*Scholtz*) and is inherited as a dominant, monomeric character. Malformations of the nails may at times be associated with deformities of the knee joints. Thus, aplasia (hypoplasia) of the patella, also a dominant character, has been reported to co-exist in several families with onychatrophy (*Firth*, *Aschner* and *Engelmann*).

In a few families, moreover, the dominant malformation: dislocation of the head of the radius has been observed in association with the above-mentioned deformities of the nails and patella (*Orel*, *Oesterreicher*).

Recently, *Senturia* and *Senturia* have given a detailed description of this syndrome of malformations occurring in a family in which the symptoms of the triad were observed in 30 members in 4 generations. They emphasize that it is a hereditary affection of a dominant character and not sex-linked.

Since then *Montagard* has observed 3 cases in 3 generations and *Wilderwanck* has reported a family of 53 members 22 of whom exhibited the symptoms of the triad in various combinations.

*Thompson*, *Walker* and *Weens* have observed 4 families showing deformities of the nails, knees, and elbows in association with an anomaly of the pelvis (iliac horns). Quite recently *Hawkins, C. F.* and *O. E. Smith* published a family with the symptoms of the triad combined with iliac horns and renal dysplasia (Lancet *258*. 803. 1950).

Recently the writer had occasion to observe the rare triad of congenital malformations: onychatrophy, aplasia (hypoplasia) of the patella, and dislocation of the head of the radius in 2 families, including monozygotic twins.

*Family I.*

Male (1). Nails of the thumbs (fig. 1) are about one-third the normal size, thickened, depressed, and with a small nail bed. Nails of the index fingers are about two-thirds of normal size, grooved and thickened. The nails of the remaining fingers and of the toes were normal.

*Fig. 1.* Family I, male (1). Atrophic nails of the thumb.

*Elbow joint* shows about 20° short of full extension. X-ray examination at the Bispebjerg Hospital (Mar. 31. 1951): Elbows (fig. 2): Distal ends of the humeri of striking breadth. On the right, the capitulum humeri is completely absent, and there is backward subluxation of the radius. On the left, the capitulum is preserved to some extent, but the left radius, which is of a shape similar to the right one, shows more marked backward dislocation.

*Knee joints* have both patellae very small, particularly the right one (sd. *H. H. Jacobsen*).

Brother (2). Has been a resident of the mental hospital in Middelfart since 1933. Diagnosis: Paranoid schizophrenia. The patient refused to be photographed or X-rayed, but the deformities have been described as follows: *Hands:* The distal phalanges of the thumbs and index fingers are somewhat tapering with underdeveloped and deformed nails. *Elbow:* The elbow joints appear normal, but are about 10° short of full extension. *Knees:* On inspection there appears

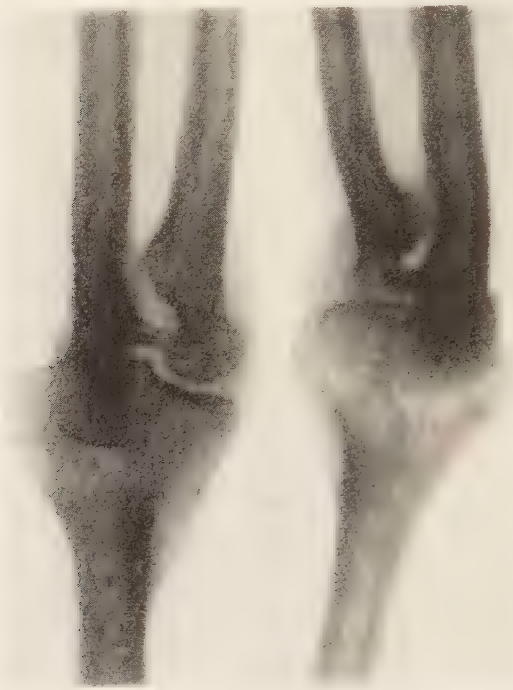

*Fig. 2.* Family I, male (1). X-ray of elbows.

to be a depression at the site of the otherwise prominent patella which is not either palpable.

The congenital abnormalities in a sister (3) and their father (4) have been aptly described by a brother as follows: "From our father my sister and two brothers have inherited the absence of nails on the thumbs and index fingers. There seems to have been a nail which has been torn off and is now crumbling away instead of growing. Furthermore, they have no knee-pan and they are unable to straighten their elbows completely". In the 3rd generation the anomaly has ocurred in 2 cases (5, 6), and in the 4th generation as yet in only one (7).

*Family II.*

In another family, which appears to be entirely unrelated to the former one, several members exhibit absolutely identical deformities: Deformed, atrophic nails on the thumbs, less so on the index fingers (fig. 3), bilateral extension defect in elbow joints due to backward dislocation of the radius, and small atrophic patellae.

*Fig. 3.* Family II. Monozygotic twin.
Atrophic nails of the thumbs and index fingers.

It is interesting that in this family the concordant occurrence of the lesion has been observed in monozygotic twins (fig. 4).

It will be seen from the pedigrees (fig. 5) that the distribution of this triad of malformations, known in the families through 4 generations, appears to indicate simple dominant heredity. All the symptoms of the triad appear to be present in each of the members affected: the co-existence of the three different malformations may be interpreted as pleiotropia.

*Fig. 4.* Monozygotic twins with extension defect in elbow joints due to backward dislocation of the radius.

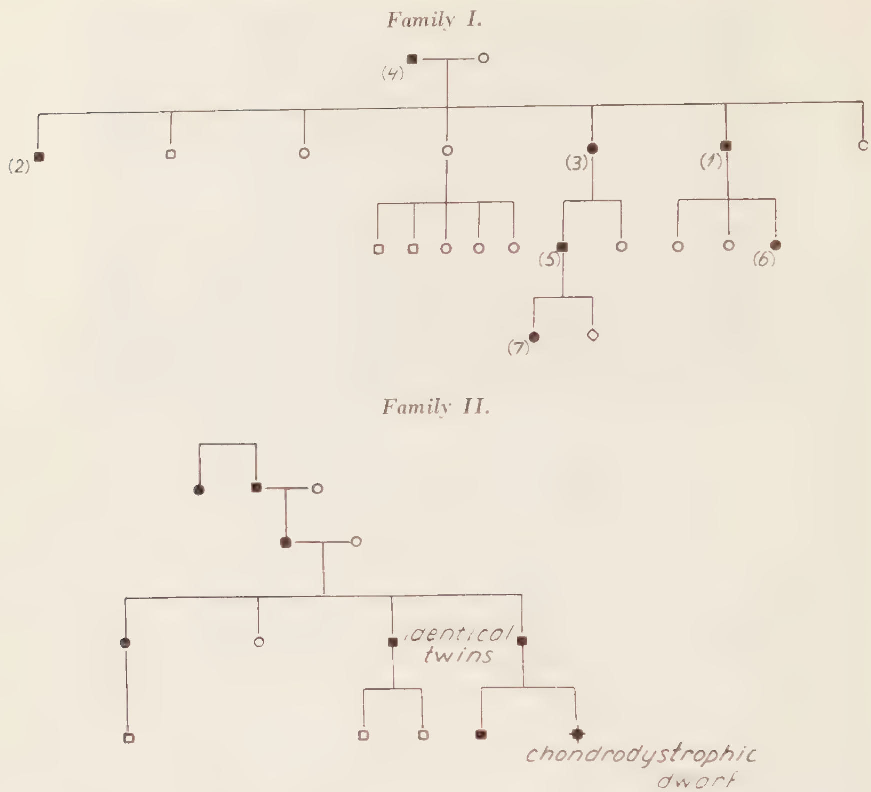


*Fig. 5.* Pedigrees of the 2 families described.

It is strange that a son of one of the twins exhibiting the syndrome of malformations (Family II) is suffering from chondrodystrophy (proven by clinical and radiological examination during a stay at the Copenhagen County Hospital in Gentofte).

Malformation of the fingers in the form of brachydactylia, i.e. a short and broad phalanx, is one link in the syndrome of chondrodystrophy, and it has been maintained that when occuring isolated, brachydactylia, which shows dominant inheritance, is a mild form of chondrodystrophy. This, however, is by no means proven (*Trier Mörch*). Among the families of chondrodystrophic patients, onychatrophy is unknown, and among the families reported with onychatrophy chondrodystrophy does not seem to have occurred. It must be emphasized also that in the cases under discussion the deformities were confined to the nails, whereas the corresponding

phalanges were entirely normal in shape and size. Therefore, a genetic relationship between the onychoses reported and chondrodystrophy does not appear likely.

*Summary.*

A syndrome of congenital malformations: onychatrophy, dislocation of the head of the radius, and hypoplasia (aplasia) of the patella has been observed among the members of two families. The syndrome was concordant in monozygotic twins and the inheritance was dominant. A case of chondrodystrophy in one of the families appears to bear no relation to the malformation of the nails.

*Résumé.*

Un syndrome de difformités congénitales: Atrophie des ongles, luxation de la tête du radius et hypoplasie (aplasie) patellaire ont été observées chez des membres de deux familles. Le syndrome fut concordant chez des jumeaux homozygotiques et l'hérédité fut dominante. Un cas de chondrodystrophie fétale dans la famille paraît être sans relation aux difformités des ongles.

*Zusammenfassung.*

Ein Syndrom von angeborenen Mißbildungen: Atrophie der Nägel, Verschiebung des Speichenkopfes und hypoplasia (aplasia) patellae sind bei Mitgliedern von zwei Sippen beobachtet worden. Das Syndrom kam bei homozygoten Zwillingen konkordant vor und war dominant erblich. Ein Fall von fötaler Chondrodystrophie in der Sippe scheint ohne Beziehung zu den genannten Nagelmißbildungen zu sein.

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# MARRIAGE AND DIVORCE RISKS

By GUNNAR DAHLBERG, Uppsala.

Statistical risks have of old been calculated with respect to mortality and the figures used to provide various information about causes of death, special death rates in selected groups of the population, etc. The same method could, obviously, be extended to other fields. But, strange to say, that has only been done on a very limited scale. Nor do the primary figures published in official statistics by any means lend themselves to a calculation of risks in all cases. This is to be deprecated, for under many circumstances the risk stood will give a far more correct and meaningful picture of the matter than other measures of frequency.

As an example of what calculations of risk can show, I should like to remark that investigations regarding the risk of alcoholism in Sweden have disclosed that more than 10 per cent of the male urban population will at least once have been entered on the books of a Temperance Board by the time they are 65 years old, provided that the risk level of 1942 remains constant. Similar results have been obtained by research into the risk of being convicted of a crime. It is a fact that more than 10 per cent of the male urban population in Sweden will have been convicted of at least one registrable crime by the time they are 55 years old. According to Swedish law, "registrable crimes" are wrongdoings that are punished by imprisonment or penal servitude, and also petty and grand larceny even if only fines are imposed. (Drunkenness and other misdemeanours are consequently not registrable.) The study was carried out in 1937.

Studies like the above are, of course, based on individuals who have committed first offences. Swedish criminal statistics, however, neglect the difference between first crimes and subsequent crimes; accordingly risks cannot be calculated from them. In the above case it was necessary to register the primary data anew. Nevertheless it would be perfectly simple to take the difference into account at the source. And, obviously, it would be a good thing if the data published in official statistics were more useful.

## *Risk of Getting Married.*

In order to estimate the risk of getting married for a woman or the chance of marrying for a man—or vice versa—figures for the annual number of persons with first marriages are related to the average population of single persons in different age groups. Officially published statistics give figures which can be used in this way. Here it will be sufficient to give figures for the period 1938–1947, with subdivisions of 1-year groups. The outcome is shown in table 1 and fig. 1.

It turns out that the risk rises quite fast from 0 to a maximum at 25–26 years for women and about 30 years for men, after which it declines rapidly at first, later more slowly towards higher ages.

*Table 1.* Annual risk of a first marriage for men and women during the period 1938–1947, the number of first married being expressed in per cent of the average single population in 1-year groups.

| Age, years | Males | Females | Age, years | Males | Females |
|---|---|---|---|---|---|
| 15—16 | — | 0.01 | 40—41 | 5.31 | 3.23 |
| 16—17 | 0.00 | 0.15 | 41—42 | 4.67 | 2.76 |
| 17—18 | 0.01 | 0.62 | 42—43 | 4.16 | 2.32 |
| 18—19 | 0.17 | 4.20 | 43—44 | 3.81 | 2.15 |
| 19—20 | 0.68 | 6.58 | 44—45 | 3.26 | 1.85 |
| 20—21 | 1.57 | 9.75 | 45—46 | 2.99 | 1.57 |
| 21—22 | 4.89 | 13.51 | 46—47 | 2.57 | 1.39 |
| 22—23 | 6.10 | 15.62 | 47—48 | 2.44 | 1.20 |
| 23—24 | 8.96 | 17.30 | 48—49 | 2.13 | 1.11 |
| 24—25 | 11.45 | 18.42 | 49—50 | 1.97 | 1.02 |
| 25—26 | 13.40 | 18.48 | 50—51 | 1.62 | 0.81 |
| 26—27 | 14.52 | 17.88 | 51—52 | 1.35 | 0.67 |
| 27—28 | 14.86 | 17.00 | 52—53 | 1.22 | 0.58 |
| 28—29 | 15.01 | 15.66 | 53—54 | 1.12 | 0.46 |
| 29—30 | 14.63 | 14.00 | 54—55 | 0.92 | 0.42 |
| 30—31 | 13.89 | 12.55 | 55—56 | 0.91 | 0.32 |
| 31—32 | 12.93 | 11.06 | 56—57 | 0.76 | 0.29 |
| 32—33 | 11.71 | 9.60 | 57—58 | 0.67 | 0.24 |
| 33—34 | 10.75 | 8.49 | 58—59 | 0.57 | 0.21 |
| 34—35 | 9.96 | 7.47 | 59—60 | 0.65 | 0.16 |
| 35—36 | 8.96 | 6.47 | 60—61 | 0.46 | 0.17 |
| 36—37 | 8.05 | 5.79 | 61—62 | 0.35 | 0.09 |
| 37—38 | 7.21 | 4.90 | 62—63 | 0.27 | 0.11 |
| 38—39 | 6.49 | 4.30 | 63—64 | 0.29 | 0.09 |
| 39—40 | 5.84 | 3.85 | 64—65 | 0.26 | 0.05 |

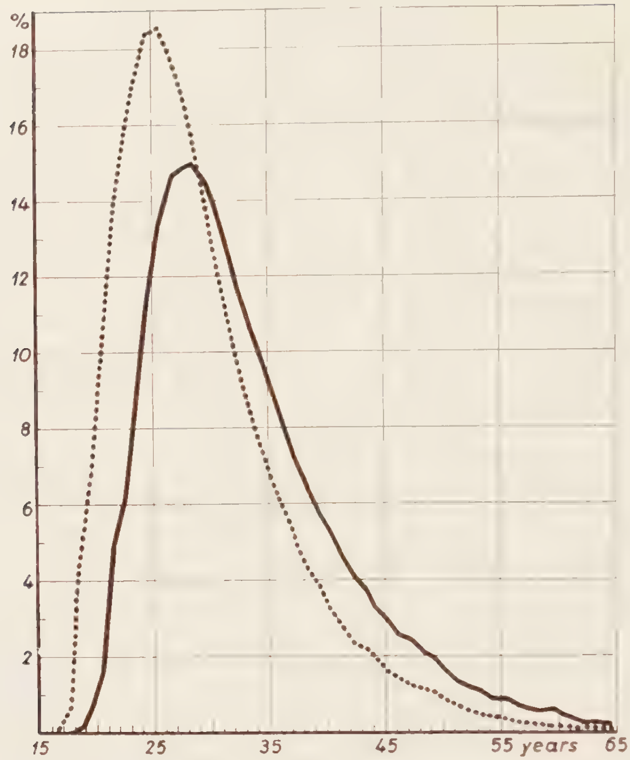


*Fig. 1.* Annual risk in per cent of a first marriage for women (dotted line) and for men (solid line) during the period 1938–1947 in different age groups.

### *Cumulative Risk of Getting Married.*

The risk figures given in the table are interesting in this connection, because they can be utilized for calculating the number of married persons at different age levels. The outcome can then be compared with the actual figures for the population. But the empirical and the calculated figures cannot be compared right away. First and foremost, the figures provided by the census represent only the proportion of *married* or *previously married* persons in an age group of a given size, while the calculated figures are valid for an age limit. Of course, reasonably accurate figures for age limits could be obtained by interpolation.

But one cannot expect theoretical and empirical figures to be wholly compatible. If that is to be the case, two conditions must be satisfied.

1. The theoretical figures are based on the assumption that married and single persons have the same death rates. Such is not the case. Single persons actually have a slightly higher death rate than married, for the former group includes ailing subjects who are unable to marry for reasons of health. The single population then should have a higher mortality, and that is precisely what has been found by empirical methods. However, the difference cannot be great.

2. A more important source of error is that the risk of marriage varies instead of remaining constant. If the risk of marriage was greater before than during the period for which the calculations are true, the empirical figures must exceed the theoretical ones and vice versa. Table 2 and fig. 2 present empirical and theoretical figures

*Table 2.* Calculated cumulative risk (on the basis of the figures in table 1) of a first marriage in per cent compared with the empirical risk in per cent up to different ages in the census of 1940.

| Age | Men | | Women | |
|---|---|---|---|---|
| | Calculated cumulative risk, % | Empirical risk, % | Calculated cumulative risk, % | Empirical risk, % |
| 20 | 0.36 | 0.51 | 9.70 | 9.48 |
| 25 | 23.14 | 22.99 | 49.52 | 47.60 |
| 30 | 58.84 | 55.82 | 75.49 | 68.84 |
| 35 | 76.56 | 71.26 | 84.33 | 74.82 |
| 40 | 83.65 | 77.68 | 87.47 | 75.92 |
| 45 | 86.84 | 82.17 | 88.77 | 77.67 |
| 50 | 88.27 | 84.19 | 89.37 | 78.03 (!) |
| 55 | 88.87 | 85.13 | 89.62 | 77.87 (!) |
| 60 | 89.24 | 86.02 | 89.72 | 78.46 |

for Sweden. The calculated figures refer to the risk of marriage for the year 1940. The empirical figures are drawn from the census for the same year, and it should be observed that the risk of marriage had showed a trend to decrease up to that time. The calculated figures were therefore likely to differ a bit from the empirical. Considering the sources of error that have been pointed out the figures seem to agree very well.

Actually it may be said, as stated previously, that this method of calculating annual and cumulative risks up to a given age tells us what the figures would be if conditions remained constant. In other words certain tacit assumptions are made. As regards matrimony it

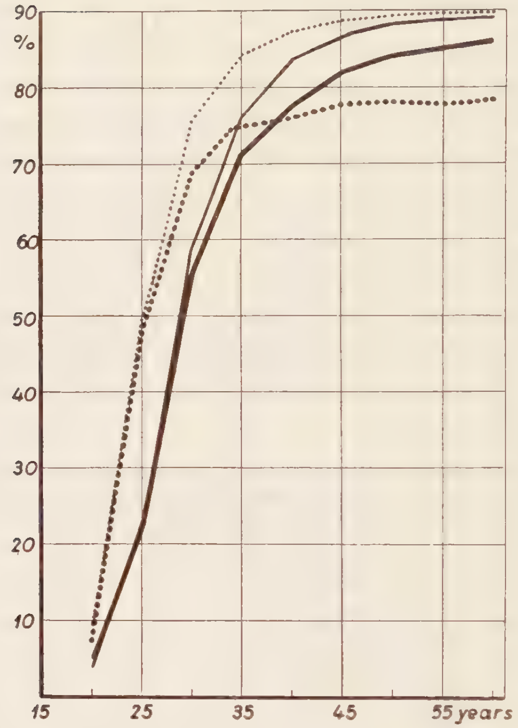


*Fig. 2.* Calculated cumulative risk of a first marriage in per cent up to different ages for men (thin solid line) and women (thin dotted line) and empirical risk for men (thick solid line) and for women (thick dotted line) in the year 1940.

is assumed that the death rate is the same in the single and in the married population, and that the marriage risk is constant. Neither assumption is quite correct. If, for example, we are dealing with the risk of a crime or of getting some disease, the corresponding hypotheses may be even more open to question.

If, under such circumstances, one desires to be particularly careful, it is advisable to use the total population in the different age groups for calculating the risks. Then it can be postulated that the criminals or the diseased persons always disappear or die as soon as they are convicted or have fallen ill. The risk figures will in other words be too low. It should be noted that these risk figures, which are too low, add up to cumulative risks that are correct. In so doing one actually assumes that criminals have an average death rate etc.

If the available risk figures are correct, they may never just be added. The cumulative risk obtained thus would be discrepantly high.

### *Risk of Being Divorced.*

The risk of divorce has increased up to the present time. A survey of the changes that have occurred is given in table 3. The cause of the higher frequency is, of course, partly changes in the

*Table 3.* Annual number of divorces per 100,000 inhabitants during the period 1851–1945.

| Years | Per 100,000 inhabitants | | |
|---|---|---|---|
| | The towns | The country | The whole of Sweden |
| 1851—1860 | — | — | 3,3 |
| 1861—1870 | — | — | 3,2 |
| 1871—1880 | — | — | 4,4 |
| 1881—1890 | 15,5 | 2,8 | 5,0 |
| 1891—1900 | 20,5 | 3,4 | 6,9 |
| 1901—1910 | 24,5 | 4,2 | 8,9 |
| 1911—1920 | 38,6 | 7,4 | 15,9 |
| 1921—1925 | 56,2 | 13,1 | 26,1 |
| 1926—1930 | 70,7 | 16,7 | 33,8 |
| 1931—1935 | 84,6 | 19,3 | 41,1 |
| 1936—1940 | 103,7 | 23,7 | 52,4 |
| 1941—1945 | 139,7 | 32,6 | 75,0 |

popular attitude to the sanctity of marriage and concomitant changes in the text and practice of the law. To some extent the changes can be due to an altered age composition of the population and to differences in the number of married couples. A clearcut idea of the rate of divorces consequently cannot be had without recourse to the risk for different years after the marriage. However, no available official figures can be used as a basis for correct computations. Therefore I have related the number of divorces distributed according to the duration of the marriage to the number of marriages for the corresponding year. Risk figures obtained thus are obviously a little high, particularly those that apply to years at some distance from the marriage. For it is impossible to know how many of the married persons died before they had time to be divorced.

*Table 4.* Annual risk of divorce up to 40 years after marriage, the number of divorces during the period 1938–47 being expressed in per cent of the number of marriages during that period.

| Number of years after the marriage | Number of divorces in % | | Number of years after the marriage | Number of divorces in % | |
|---|---|---|---|---|---|
| | The towns | The country | | The towns | The country |
| 0—1 | 0.04 | 0.01 | 20—21 | 0.18 | 0.08 |
| 1—2 | 0.40 | 0.10 | 21—22 | 0.17 | 0.06 |
| 2—3 | 0.88 | 0.26 | 22—23 | 0.16 | 0.06 |
| 3—4 | 1.01 | 0.33 | 23—24 | 0.15 | 0.06 |
| 4—5 | 0.96 | 0.31 | 24—25 | 0.13 | 0.05 |
| 5—6 | 0.92 | 0.31 | 25—26 | 0.10 | 0.05 |
| 6—7 | 0.80 | 0.25 | 26—27 | 0.11 | 0.03 |
| 7—8 | 0.71 | 0.23 | 27—28 | 0.08 | 0.03 |
| 8—9 | 0.64 | 0.22 | 28—29 | 0.07 | 0.04 |
| 9—10 | 0.52 | 0.20 | 29—30 | 0.05 | 0.03 |
| 10—11 | 0.52 | 0.17 | 30—31 | 0.05 | 0.03 |
| 11—12 | 0.45 | 0.17 | 31—32 | 0.05 | 0.02 |
| 12—13 | 0.40 | 0.15 | 32—33 | 0.04 | 0.02 |
| 13—14 | 0.37 | 0.14 | 33—34 | 0.03 | 0.02 |
| 14—15 | 0.31 | 0.12 | 34—35 | 0.03 | 0 02 |
| 15—16 | 0.30 | 0.11 | 35—36 | 0.02 | 0.01 |
| 16—17 | 0.27 | 0.10 | 36—37 | 0.02 | 0.01 |
| 17—18 | 0.26 | 0.10 | 37—38 | 0.02 | 0.01 |
| 18—19 | 0.22 | 0.10 | 38—39 | 0.01 | 0.01 |
| 19—20 | 0.20 | 0.09 | 39—40 | 0.02 | 0.01 |

Table 4 is based on figures for the years 1938–1947 and fig. 3 shows the same thing graphically also for an earlier period. Since, as appears in the table, the position is very different for the rural and the urban population the figures for the two categories will be kept apart. It will be seen that the risk of divorce increases from the time of the marriage to a maximum about 4 years later. For the urban population it reaches 0.8 per cent in the earlier period and 1 per cent in the later period. After that it declines very slowly. Strangely enough, the risk of divorce persists as long as 40 years after the marriage. Even then it has not reached 0.

## *Cumulative Risk of Being Divorced.*

A more concrete picture of what these risk figures imply can be had by computing the cumulative risk of divorce. Using the same

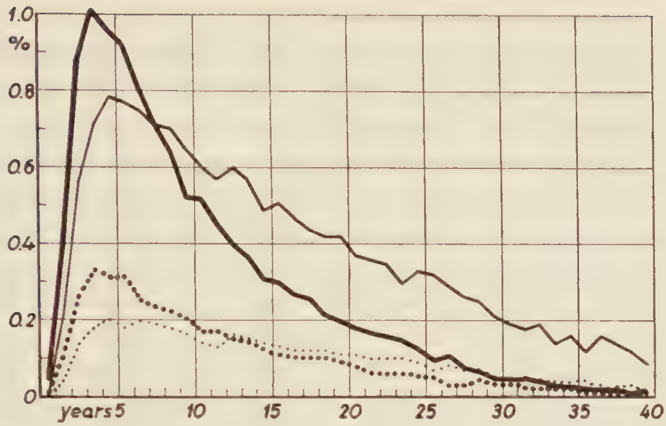


*Fig. 3.* Annual risk of divorce in per cent up to 40 years after marriage for the urban population (solid lines) and the rural population (dotted lines). The thin lines indicate the annual risk during the period 1926–1935, the thick lines the annual risk during the period 1938–1947.

procedure as for marriage, we obtain the figures in table 5 which are illustrated in fig. 4. Rural and urban populations are still kept apart.

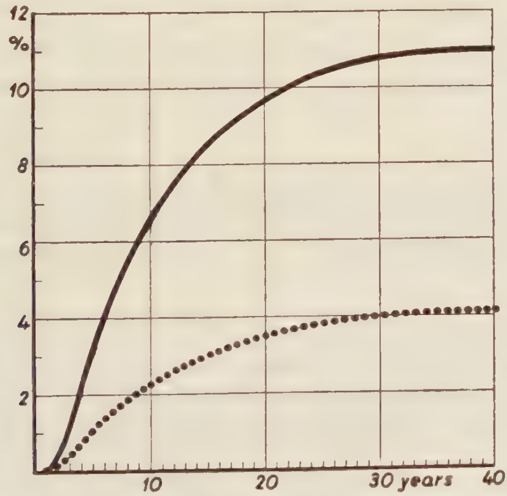


*Fig. 4.* Calculated cumulative risk of divorce in per cent up to 40 years after marriage for the urban population (solid line) and the rural population (dotted line) in 1940.

*Table 5.* Cumulative risk of divorce up to 40 years after marriage, calculated on the annual number of divorces during the period 1938–47, being expressed in per cent of the number of marriages during that period.

| Number of years after the marriage | Calculated cumulative risk, % | | Number of years after the marriage | Calculated cumulative risk, % | |
|---|---|---|---|---|---|
| | The towns | The country | | The towns | The country |
| 1 | 0.04 | 0.01 | 21 | 9.89 | 3.55 |
| 2 | 0.44 | 0.11 | 22 | 10.04 | 3.61 |
| 3 | 1.32 | 0.37 | 23 | 10.18 | 3.67 |
| 4 | 2.32 | 0.70 | 24 | 10.31 | 3.73 |
| 5 | 3.26 | 1.01 | 25 | 10.43 | 3.78 |
| 6 | 4.15 | 1.32 | 26 | 10.52 | 3.83 |
| 7 | 4.92 | 1.57 | 27 | 10.62 | 3.86 |
| 8 | 5.60 | 1.80 | 28 | 10.69 | 3.89 |
| 9 | 6.20 | 2.02 | 29 | 10.75 | 3.93 |
| 10 | 6.69 | 2.22 | 30 | 10.79 | 3.96 |
| 11 | 7.18 | 2.39 | 31 | 10.83 | 3.99 |
| 12 | 7.60 | 2.56 | 32 | 10.87 | 4.01 |
| 13 | 7.97 | 2.71 | 33 | 10.91 | 4.03 |
| 14 | 8.31 | 2.85 | 34 | 10.94 | 4.05 |
| 15 | 8.59 | 2.97 | 35 | 10.97 | 4.07 |
| 16 | 8.86 | 3.08 | 36 | 10.99 | 4.08 |
| 17 | 9.11 | 3.18 | 37 | 11.01 | 4.09 |
| 18 | 9.35 | 3.28 | 38 | 11.03 | 4.10 |
| 19 | 9.55 | 3.38 | 39 | 11.04 | 4.11 |
| 20 | 9.73 | 3.47 | 40 | 11.06 | 4.12 |

For the urban population, it will be seen that the cumulative risk of being divorced after 5 years is 3.26 per cent, after 10 years 6.7 per cent, after 20 years 9.7 per cent and, lastly, after 40 years 11.06 per cent.

These cumulative risks are based on the assumption that the risk is constant, i.e. that conditions do not change and that divorces are neither rarer nor commoner in the future than they were 1938–1947. It is by no means self-evident that this should be so.

If the figures for cumulative risk are used to illustrate the significance at any specified time of the risks then prevailing, it is obviously of no consequence that they vary from year to year.

### *Divorce and Social Standing.*

In the two tables we have distinguished only between rural and urban populations. But differences obviously exist within the groups. The age of the parties when they marry must, for example, surely have an effect on the risk of divorce. By means of official statistics, however, it is impossible to assess such factors.

Social standing is naturally an important factor with regard to the divorce rate. It is higher among wealthy than among poor people simply because a divorce costs money. A poor couple cannot afford to be divorced. The rate is, moreover, influenced by special codes and mores that are prevalent in a class of the population. Presumably, therefore, divorces are comparatively rare in groups such as the clergy and deeply religious persons. Even if our faith unlike the Catholic does not forbid them, divorces are frowned upon in church circles. There exist only limited means, however, of obtaining data on the divorce rate in different sections of society. One must seek information in occupational statistics. Table 6 is compiled from data found therein.

The figures in the table are not quite exact. The grouping by occupation is not quite the same for divorcees as for the population, and the rates are therefore unreliable, but they nevertheless give a fair idea of the situation.

*Table 6.* The annual number of divorces in different occupational (male) groups during the period 1921–1930 in relation to the number of married men per December 31st 1920.

| Occupations: | Number of divorces in per cent: |
|---|---|
| I. *Agriculture and subsidiary occupations* | 0.05 |
| A. Agriculture and animal husbandry | 0.05 |
| Landowners | 0.04 |
| Others | 0.07 |
| B. Fishery | 0.04 |
| C. Forestry | 0.06 |
| II. *Industry and trades* | 0.22 |
| III. *Commerce and communications* | 0.40 |
| Banking and insurance | 0.59 |
| Hotels and restaurants | 0.72 |
| Post office, telegraph and telephone | 0.18 |
| Railways and tramlines | 0.16 |
| Merchant navy masters and mates | 0.51 |
| Truckers, chauffeurs, etc. | 0.85 |

| Occupations: | Number of divorces in per cent: |
|---|---|
| IV. *Civil service and professions* | 0.46 |
| State and local government | 0.58 |
| Officers | 1.22 |
| Noncommissioned officers and men | 0.45 |
| Swedish church clergy | 0.10 |
| Swedish church laymen | 0.07 |
| Teachers | 0.30 |
| Lawyers | 1.09 |
| Authors, journalists, etc. | 1.32 |
| Sculptors, painters, actors, etc. | 0.79 |
| Physicians and dentists, etc. | 0.82 |
| Veterinaries, pharmacists, etc. | 0.38 |
| V. *Domestic service* | 0.80 |
| VI. *Retired and others* | 0.16 |
| Capitalists and houseowners | 0.04 |
| Students at universities, etc. | 0.62 |
| Mean | 0.44 |

The table reveals that the divorce rate is low among persons with agricultural occupations, as already has been demonstrated by the fact that the rural divorce rate is lower than the urban. The low rate for the clergy and lay employees of the Swedish Church was also expected. Among groups with a high rate we find the hotel and restaurant trades. The high figures for masters and mates in the mercantile marine are probably due to special factors. Others with high rates are officers and lawyers, authors and journalists, and also artists of various sorts. It is perhaps more surprising that physicians and dentists have so high divorce rates.

To give another aspect of the problem we have listed the number of divorcees in different occupational groups. These figures too must be accepted with some reserve, even if the relations between the groups probably represent actual conditions. (See table 7.)

The table shows that, as before, the agricultural occupations have a particularly low rate, just as have the clergy and laymen in the employ of the Swedish Church. A high frequency is on the whole found in the same occupations as in the preceding table, viz. restaurant workers, travellers and office workers, officers and above all lawyers, barristers, publicists, etc., as well as artists and equivalent groups. It has now become possible to differentiate physicians and dentists, and we find that the high divorce rate is due to the

*Table 7.* Number of divorced men in different occupations (from the 1920 census).

| Occupations: | Number of divorced men, in per cent: |
|---|---|
| I. *Agriculture and subsidiary occupations* | 0.21 |
| A. Agriculture and animal husbandry | 0.19 |
| Landowners | 0.13 |
| Others | 0.28 |
| B. Fishery | 0.21 |
| C. Forestry | 0.35 |
| II. *Industry and trades* | 0.62 |
| III. *Commerce and communications* | 0.78 |
| Wholesalers, directors, agents, etc. | 1.39 |
| Office workers and travellers | 1.77 |
| Shop workers, warehousemen, caretakers, etc. | 0.77 |
| Hotels and restaurants: | |
| Owners | 0.62 |
| Personnel | 1.78 |
| Banking and insurance: | |
| Staff | 0.62 |
| Clerks | 0.27 |
| Post office, telegraph and telephone | 0.67 |
| Railways and tramlines | 0.29 |
| Truckers, chauffeurs, etc. | 0.98 |
| Merchant navy masters and mates | 1.07 |
| Shippers | 0.10 |
| Ships' engineers, pilots and other seamen | 1.11 |
| IV. *Civil service and professions* | 0.88 |
| State and local government | 0.76 |
| Officers | 1.16 |
| Noncommissioned officers and men | 0.41 |
| Swedish church clergy | 0.25 |
| Swedish church laymen | 0.55 |
| Teachers | 0.81 |
| Lawyers and barristers | 2.55 |
| Publicists, writers, etc. | 2.36 |
| Artists | 2.97 |
| Staff and personnel at scientific institutions, art galleries etc. | 0.86 |
| Physicians | 1.54 |
| Dentists, body culturists, etc. | 3.17 |
| Veterinaries, pharmacists, etc. | 1.04 |
| Staff and personnel at hospitals, poorhouses, prisons, etc. | 0.46 |
| V. *Domestic service:* | |
| Butlers, caretakers, woodcutters, etc. | 1.07 |

| Occupations: | Number of divorced men, in per cent: |
|---|---|
| VI. *Retired and others* | 1.35 |
| Capitalists, owners of large houses (chiefly in towns and large communities) | 1.27 |
| Owners of small houses (chiefly rural) | 0.55 |
| Students at universities, etc. | 1.22 |
| No specified occupation | 5.74 |
| Beneficiaries of public relief | 7.15 |
| Vagrants and convicts | 7.89 |
| Mean | 1.37 |

dentists. They finish their education early, so their divorces occur after they have entered professional life. Presumably that is not true to the same extent of physicians. Nevertheless, the difference between physicians and dentists is too great to be caused by this factor alone. That persons with no specified occupation and beneficiaries of public relief have such a high divorce rate is rather surprising. The explanation must probably be looked for in the irregular life led by many members of these groups. That definitely is the case with regard to the group of vagrants and convicts.


### *Summary.*

In the present paper the probability of divorce in Sweden according to the length of marriage is given. The probability of divorce in different occupational groups is also discussed.

### *Résumé.*

Analyse de la probabilité de divorce en Suède par rapport à la durée du mariage. La probabilité de divorce dans des groupes professionnels différents est aussi discutée.

### *Zusammenfassung.*

In der vorliegenden Arbeit wird die Wahrscheinlichkeit für Ehescheidung in Schweden im Hinblick auf die Dauer der Ehe besprochen. Weiterhin wird die Wahrscheinlichkeit für Ehescheidung in verschiedenen Berufsgruppen besprochen.

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# STUDIES ON THE ERUPTION OF THE PERMANENT TEETH

## *I. The Age at the Eruption of the Different Teeth in the Normal School Population in Hungary.*

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The process of eruption of the permanent teeth has been studied multitudinously. The first systematic study was conducted by *Sir Edwin Sanders*, in order to obtain some reliable objective criterion for judging the age of juvenile individuals, independently of what the parents were contending. The results of this study were published in a monograph, entitled: The teeth as a test of age [1837]. – Subsequent studies were mostly confined to determining the mean and median ages at which a specified tooth usually erupts. *Magitot* [1883], *Broca* [1879], *Welcker* [1886], and others expressed the age of tooth eruption on the basis of that age at which fifty per cent of the individuals under observation had a particular tooth in the mouth, so obtaining the median ages of tooth eruption. Besides this item, *Boas* calculated the standard deviation of the age distribution of the individual permanent teeth. *Cattell* [1928] determined the median ages of eruption and the lower and upper quartile ranges of age distribution, and furthermore the median number of permanent teeth erupted at successive chronological ages between 5 ½ and 15 years. The normal probability curve was used by *Klein, Palmer* and *Kramer* [1937] for expressing the age distribution of erupting permanent teeth. A similar method was adopted by *Dahlberg* and *Maunsbach* [1948] in studying the eruption of the permanent teeth in the normal population of Sweden. In their report results of earlier investigations are tabulated also, mainly from the European continent.

All these studies were carried out in a manner that a more or less great number of subjects in tooth eruption age were examined once, and the data obtained were grouped according to the age of the individuals. This type of survey is referred to by *Jackson* ([1950]; in connection with surveys on caries incidence) as static.

On the other hand, *Hellman* [1943] determined the mean age at the eruption of the permanent teeth by repeated examinations of the subjects. A difference was found between children of well-to-do and poor families. An identical method was used in the recent study of *Stones*, *Lawton*, *Bransby* and *Hartley* [1951]. In presenting the data the average age of eruption is given for each particular tooth.

In addition to these studies, data on the eruption of the permanent teeth were collected in Hungary too.

*Material and methods.* Our data are based on more than 8,300 children attending the compulsory eight class schools in one of the following 10 localities in the north-eastern part of the Hungarian lowland: Békésszentandrás, Dévaványa, Endröd, Gyoma, Hajdunánás, Kunszentmárton, Nyirbátor, Öcsöd, Szeghalom and Ujfehértó, with inhabitants between approximately 6,000 and 15,000.

The primary purpose of the investigations was to collect data on the relationship between caries incidence and fluorine, in a region with better teeth than in the USA (*Adler* [1951]). According to the epidemiological requirements of such studies, as outlined by *Dean* [1946], only children born and continuously resident in the single communities were taken into consideration.

In one of our 10 communities the domestic waters contain markedly protective levels of F (approximately 1 ppm); in three the fluorine level is between 0.5 and 0.8 ppm; in one, the one part of the village is using a well with 1.2 ppm, the other part and all other communities having domestic waters with less F than 0.5 ppm.

In Hungary enrolment to school occurs usually after having passed the 6th birthday; eight classes are compulsory. Thus, our material comprises all children, born and continuously resident in the 10 communities, who were between their 7th and 14th birthdays, and a part of the children, who had passed their 6th birthday but not yet the 7th one. Taking into consideration the date of examination and of birth, the chronological age was determined and full year groups were formed. Taking for granted an even distribution within each year, the ages of the subjects are given as 6 ½, 7 ½ etc. up to 13 ½. This surely is not true for the 6 ½-year-old group, since

in some communities examinations were carried out in the late stages of the school year, thus all children having passed the 6th, but not the 7th birthday, were nearer to the latter.

The number of permanent teeth visible in the mouth were recorded and added. The total number has been expressed in per cent of the double number of subjects in the group, i.e. of the expected number of each specified tooth. The percentage values are the basis of the further analysis of the data.

The average age of the subjects and the percentage number of each individual tooth were recorded graphically; a typical probability curve was then obtained. From this, as shown in fig. 1, the eruption time attributable to the presence of 25 and 75 per cent of the total number has been determined. In an identical manner, the time value corresponding to the 50 per cent presence of each tooth has been determined also. Since the initial and final stages of the curves display some irregularities, due to precocious and/or delayed shedding

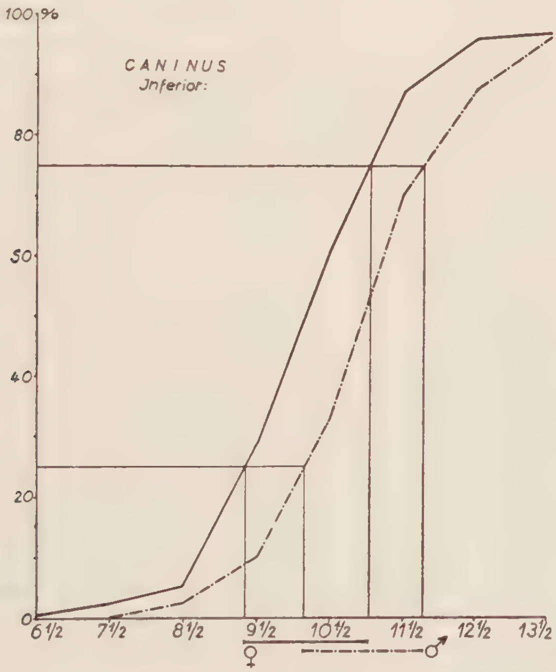


*Fig. 1.* Diagram showing the eruption of lower cuspids in boys and girls, demonstrating the method of determining the time values, attributable to the 25 and 75 per cent presence of these particular teeth.

of the deciduous teeth, respectively the eruption of the permanent ones, they are not taken into consideration.

*Results.* The basic data are compiled in tables 1 and 2 for girls and boys. In fig. 2 the interval between the 25 and 75 per cent tooth presence values is demonstrated for the upper and lower teeth in girls as well as in boys. The 50 per cent presence is shown too. The data compiled in fig. 2 confirm the wellknown facts that

1. the eruption of the permanent teeth occurs earlier in girls than in boys;

2. except for the premolars, the eruption of the lower teeth occurs before that of their upper mates. As regards the premolars, in the first the reverse seems to hold true, while in the second the differences are but slight.

3. There is a time lag between the eruption of the first molars and incisors on the one hand, and the other teeth on the other hand, the former forming the first, the latter the second group of erupting permanent teeth.

*Table 1.*

*The eruption of the permanent teeth in Hungarian boys.*

| Age and number of subjects | Incisors central No. | % | Incisors lateral No. | % | Cuspid No. | % | Premolars first No. | % | Premolars second No. | % | Molars first No. | % | Molars second No. | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 ½ | 112 | 15 | 15 | 2 | — | — | 1 | — | — | — | 533 | 73 | — | — |
| 371 | 395 | 53 | 63 | 8,5 | — | — | — | — | 6 | 1 | 564 | 76 | — | — |
| 7 ½ | 658 | 56 | 129 | 11 | 1 | — | 29 | 2,5 | 4 | 0,35 | 1101 | 93 | — | — |
| 585 | 1028 | 86 | 485 | 41 | — | — | 5 | 0,4 | 7 | 0,6 | 1127 | 96 | — | — |
| 8 ½ | 1121 | 96 | 608 | 52 | 15 | 1.2 | 118 | 10 | 20 | 1,5 | 1157 | 99 | — | — |
| 584 | 1153 | 99 | 901 | 77 | 30 | 2.5 | 24 | 2 | 8 | 0,6 | 1162 | 100 | 3 | 0.3 |
| 9 ½ | 1156 | 98 | 1023 | 86 | 45 | 3.8 | 311 | 26 | 117 | 10 | 1184 | 100 | 7 | 0.6 |
| 592 | 1182 | 100 | 1112 | 94 | 111 | 10 | 134 | 12 | 58 | 5 | 1182 | 100 | 25 | 2 |
| 10 ½ | 1234 | 97 | 1186 | 95 | 170 | 14 | 563 | 45 | 333 | 27 | 1242 | 100 | 68 | 5.4 |
| 621 | 1242 | 100 | 1228 | 97 | 371 | 29 | 362 | 32 | 216 | 17 | 1242 | 100 | 138 | 11 |
| 11 ½ | 1236 | 100 | 1225 | 99 | 511 | 41 | 887 | 72 | 627 | 51 | 1236 | 100 | 290 | 23 |
| 618 | 1236 | 100 | 1236 | 100 | 845 | 70 | 809 | 65 | 524 | 42 | 1236 | 100 | 468 | 38 |
| 12 ½ | 1014 | 100 | 1009 | 100 | 689 | 68 | 881 | 87 | 748 | 77 | 1014 | 100 | 493 | 49 |
| 507 | 1014 | 100 | 1013 | 100 | 879 | 87 | 826 | 81 | 656 | 65 | 1014 | 100 | 679 | 67 |
| 13 ½ | 862 | 100 | 862 | 100 | 736 | 85 | 834 | 97 | 762 | 88 | 862 | 100 | 675 | 79 |
| 431 | 862 | 100 | 862 | 100 | 829 | 96 | 809 | 94 | 727 | 82 | 862 | 100 | 773 | 90 |

At each particular age in the upper horizontal row data for the upper, in the lower one for the lower teeth are given.

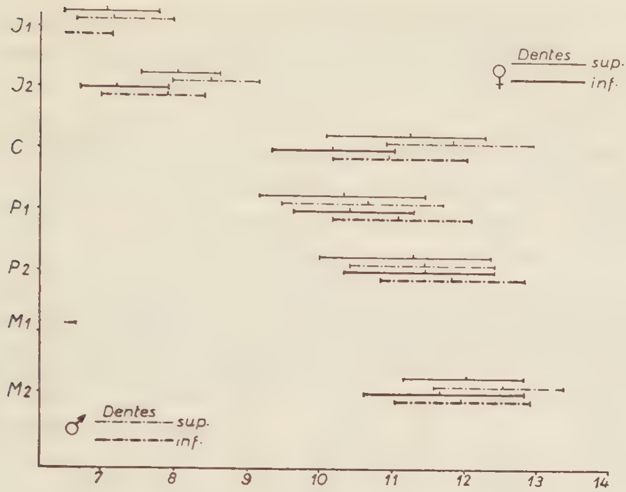


*Fig. 2.* The time interval between the 25 and 75 per cent values of the different teeth. The time attributable to the 50 per cent value is marked also.

*Table 2.*

*The eruption of the permanent teeth in Hungarian girls.*

| Age and number of ubjects | Incisors central No. | % | Incisors lateral No. | % | Cuspid No. | % | Premolars first No. | % | Premolars second No. | % | Molars first No. | % | Molars second No. | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6½ | 163 | 25 | 14 | 2 | — | — | 1 | — | — | — | 521 | 79 | — | — |
| 329 | 429 | 65 | 93 | 14 | 3 | 0.5 | — | — | — | — | 574 | 87 | — | — |
| 7½ | 732 | 67 | 256 | 23 | 5 | 0.4 | 32 | 2.7 | 2 | 0.2 | 1061 | 96 | — | — |
| 550 | 937 | 85 | 715 | 65 | 26 | 2.5 | 5 | 0.4 | 6 | 0.5 | 1083 | 98 | 1 | — |
| 8½ | 1064 | 96 | 807 | 73 | 9 | 0.8 | 110 | 10 | 19 | 1.6 | 1102 | 100 | 5 | 0.4 |
| 553 | 1100 | 100 | 998 | 88 | 60 | 5.4 | 57 | 5.2 | 33 | 3 | 1105 | 100 | 14 | 1.3 |
| 9½ | 1151 | 100 | 1055 | 91 | 79 | 7 | 325 | 28 | 107 | 9 | 1154 | 100 | 16 | 1.5 |
| 577 | 1154 | 100 | 1121 | 97 | 344 | 29 | 234 | 20 | 113 | 10 | 1154 | 100 | 52 | 4.5 |
| 0½ | 1178 | 100 | 1149 | 97 | 341 | 30 | 634 | 54 | 370 | 31 | 1178 | 100 | 98 | 8 |
| 589 | 1178 | 100 | 1175 | 100 | 709 | 61 | 615 | 52 | 351 | 29 | 1178 | 100 | 255 | 22 |
| 1½ | 1064 | 100 | 1064 | 100 | 575 | 54 | 811 | 76 | 589 | 55 | 1064 | 100 | 355 | 32 |
| 532 | 1064 | 100 | 1064 | 100 | 928 | 87 | 847 | 80 | 548 | 51 | 1064 | 100 | 541 | 51 |
| 2½ | 948 | 100 | 946 | 100 | 766 | 81 | 871 | 92 | 755 | 80 | 948 | 100 | 612 | 65 |
| 474 | 946 | 100 | 947 | 100 | 906 | 96 | 877 | 92 | 737 | 78 | 948 | 100 | 762 | 80 |
| 3½ | 840 | 100 | 840 | 100 | 775 | 92 | 817 | 97 | 771 | 92 | 840 | 100 | 733 | 87 |
| 420 | 840 | 100 | 840 | 100 | 818 | 97 | 806 | 96 | 731 | 87 | 840 | 100 | 768 | 91 |

At each particular age in the upper horizontal row data for the upper, in the lower one for he lower teeth are given.

4. Though by lack of subjects less than 6 years old in our material and the non-representativeness of the 6 ½-year-old group conclusions

*Table 3.*

*The average age at the eruption of the different permanent teeth in different populations.*

| Upper or lower | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Source of data and number of subjects |
|---|---|---|---|---|---|---|---|---|
| | | | | | A. *Boys.* | | | |
| Upper | 7,17 | 8,50 | 11,84 | 10,67 | 11,46 | — | 12,54 | Recent study, Hungary, |
| Lower | — | 7,92 | 10,96 | 11,08 | 11,92 | — | 11,96 | 4309 |
| Upper | 7,23 | 8,51 | 11,84 | 10,62 | 11,64 | 6,39 | 12,57 | *Wourinen*, Finnland, sec. |
| Lower | 6,29 | 7,40 | 10,84 | 10,77 | 11,50 | 6,06 | 12,05 | *Hellman*, 3557 |
| Upper | 7,2 | 8,5 | 11,7 | 10,1 | 10,9 | — | 12,5 | *Dahlberg & Maunsbach*, |
| Lower | — | 7,3 | 10,7 | 11,1 | 11,6 | — | 11,9 | Sweden, 3067 |
| Upper | 7,67 | 8,92 | 12,17 | 10,42 | 11,33 | 6,58 | 12,42 | *Röse*, sec. *Dahlberg*, Ger- |
| Lower | 6,84 | 7,92 | 11,17 | 11,25 | 12,00 | 6,42 | 12,25 | many, etc. 21139 |
| Upper | 8,10 | 8,85 | 12,24 | 10,93 | 11,38 | 6,72 | 12,43 | *Stones & al.*, Gt. Britain |
| Lower | 6,85 | 8,12 | 11,41 | 11,40 | 12,12 | 6,91 | 12,16 | 189 (serial study) |
| Upper | 7,33 | 8,60 | 12,01 | 11,17 | 12,21 | 6,75 | 12,96 | *Hellman*, New York, |
| Lower | 6,29 | 7,55 | 11,04 | 11,09 | 12,32 | 6,82 | 12,89 | 452 (serial study) |
| Upper | 7,49 | 8,62 | 11,80 | 10,42 | 11,18 | 6,64 | 12,70 | *Klein & al.*, Hagerstown, |
| Lower | 6,50 | 7,64 | 10,70 | 10,75 | 11,45 | 6,44 | 12,20 | 2232 |
| Upper | 7,55 | 8,78 | 11,27 | 9,71 | 10,58 | 6,13 | 12,59 | *Sullivan*, sec. *Hellmar*, |
| Lower | 6,44 | 7,57 | 10,42 | 10,01 | 10,94 | 5,79 | 11,79 | China, 802 |
| Upper | 5,98 | 6,98 | 10,17 | 10,11 | 10,66 | 5,26 | 11,36 | *Suk*, sec. *Hellman*, Zululand, |
| Lower | 5,47 | 5,96 | 9,63 | 10,10 | 10,75 | 5,23 | 11,04 | 492 |
| | | | | | B. *Girls.* | | | |
| Upper | 7,08 | 8,04 | 11,25 | 10,33 | 11,27 | — | 12,04 | Recent study, Hungary, |
| Lower | — | 7,21 | 10,17 | 10,42 | 11,46 | — | 11,67 | 4024 |
| Upper | 6,93 | 8,16 | 10,83 | 10,14 | 11,27 | 6,17 | 12,12 | *Wuorinen*, l. c., Finnland |
| Lower | 6,10 | 7,08 | 9,73 | 10,06 | 10,89 | 5,81 | 11,55 | 3598 |
| Upper | 7,0 | 8,1 | 11,1 | 9,8 | 10,4 | — | 12,0 | *Dahlberg & Maunsbach*, |
| Lower | — | 7,1 | 9,7 | 10,1 | 10,9 | — | 11,5 | Sweden, 2963 |
| Upper | 7,42 | 8,50 | 11,58 | 10,08 | 11,08 | 6,50 | 12,42 | *Röse*, l. c., Germany etc. |
| Lower | 6,58 | 7,58 | 10,25 | 10,67 | 11,58 | 6,25 | 11,75 | 19882 |
| Upper | 7,67 | 8,66 | 12,01 | 10,47 | 11,11 | 6,60 | 12,11 | *Stones & al.*, Gt. Britain |
| Lower | 6,81 | 8,05 | 10,67 | 11,43 | 12,01 | 6,57 | 12,21 | 140 (serial study) |
| Upper | 7,24 | 8,17 | 11,75 | 10,83 | 11,94 | 6,89 | 12,93 | *Hellman*, New York |
| Lower | 6,26 | 7,43 | 10,26 | 10,66 | 11,74 | 6,70 | 12,61 | 590 (serial study) |
| Upper | 7,20 | 8,15 | 11,05 | 10,00 | 10,82 | 6,54 | 12,40 | *Klein & al.*, Hagerstown |
| Lower | 6,19 | 7,31 | 9,85 | 10,20 | 11,00 | 6,12 | 11,90 | 2153 |
| Upper | 7,18 | 8,48 | 10,90 | 9,39 | 10,30 | 6,35 | 12,42 | *Sullivan*, l. c., China |
| Lower | 6,44 | 7,41 | 9,96 | 9,69 | 10,57 | 6,05 | 11,61 | 730 |
| Upper | 6,18 | 7,14 | 9,71 | 9,76 | 10,06 | 5,77 | 10,92 | *Suk*, l. c., Zululand, |
| Lower | 5,85 | 6,23 | 9,12 | 9,76 | 10,24 | 5,49 | 10,61 | 516 |

must be drawn with the utmost care, the eruption intervals (time interval between the 25 and 75 per cent values) of the second group are seemingly longer than those of the first one. This difference may be—but only partly—due to more frequent disturbances in the shedding of the temporary posteriors than of incisors.

In table 3, for comparison's sake, the mean ages of tooth eruption in our material are compared with eruption data in children from other racial strains, living under different environmental conditions. In interpreting the data, attention should be paid to the fact that our material is made up of children living in agricultural areas, of a low urbanisation level. The differences are—in comparison with other white populations—in spite of this fact very small, and statistically far from being significant.

The primary aim of our present study has been to examine whether or not the stage of eruption of the permanent teeth offers a reliable criterion for assessment of biological age. For this purpose,

*Table 4.*

Average eruption ages, with standard deviations, of the different permanent teeth in Hungarian girls and boys, and the range between M+3 $\sigma$ and M—3 $\sigma$.

| Jaw and tooth | Boys Aver. ± S. D. M. $\sigma$ | Range between M+3 $\sigma$ a. M—3 $\sigma$ | Girls Aver. ± S. D. M. $\sigma$ | Range between M+3 $\sigma$ a. M—3 $\sigma$ |
|---|---|---|---|---|
| *Upper teeth* | | | | |
| first incisor | 7,17 ± 0,96 | 4,29 — 10,05 | 7,08 ± 0,96 | 4,20 — 9,96 |
| second incisor | 8,50 ± 0,88 | 5,86 — 11,14 | 8,04 ± 0,79 | 5,67 — 10,41 |
| cuspid | 11,84 ± 1,50 | 7,14 — 16,34 | 11,25 ± 1,63 | 6,36 — 16,14 |
| first premolar | 10,67 ± 1,67 | 5,66 — 16,33 | 10,33 ± 1,71 | 5,20 — 15,46 |
| second premolar | 11,46 ± 1,50 | 6,96 — 15,96 | 11,27 ± 1,75 | 6,02 — 16,52 |
| first molar | ........... | | ........... | |
| second molar | 12,54 ± 1,33 | 8,55 — 16,53 | 12,04 ± 1,25 | 8,29 — 15,79 |
| *Lower teeth* | | | | |
| first incisor | ........... | | ........... | |
| second incisor | 7,92 ± 1,04 | 4,60 — 11,04 | 7,21 ± 0,88 | 4,57 — 9,85 |
| cuspid | 10,96 ± 1,11 | 7,63 — 14,29 | 10,17 ± 1,25 | 6,42 — 13,92 |
| first premolar | 11,08 ± 1,42 | 6,82 — 15,34 | 10,42 ± 1,25 | 6,67 — 14,17 |
| second premolar | 11,92 ± 1,50 | 7,42 — 16,42 | 11,46 ± 1,54 | 6,84 — 16,08 |
| first molar | ........... | | ........... | |
| second molar | 11,96 ± 1,38 | 7,82 — 16,10 | 11,67 ± 1,63 | 6,78 — 16,56 |

S. D. = Means standard deviation of the mean.
Aver. = Age at which 50 per cent of the total number of a specified tooth is visible in the mouth.

the standard deviations of the average eruption ages have been computed for the different teeth, according to the formula given by *Dahlberg* and *Maunsbach*, viz.

$$\sigma = \frac{Q_3 - Q_1}{1.349}$$

$Q_3$ is the time value attributable to 75 per cent presence of teeth, while $Q_1$ to 25 per cent.

The data obtained are summarized in table 4. In a normal distribution only 0.15 per cent are reckoned above the limit of 3 $\sigma$ from the mean and as many below the limit, forming totally 0.30 per cent of the total population. This has been controlled in our material too, and has been found to hold true. However, as a clinician one can hardly get rid of the impression that the time variations set up by this significance test are too wide for clinical use. Clinically, acceleration and retardation *within* the limits of insignificance may have some importance also. Thus, in clinical use, especially when judging the stage of dentition in individual cases, other criteria are to be used.

In table 5 the average number of erupted permanent teeth (disregarding third molars) are summarized at specified chronological ages. Taking into consideration the values as shown in table 4, a wide variability is obvious. Values of $\sigma$ for this item are given by *Dahlberg* and *Maunsbach* for their material from Sweden, varying up to 4.85 teeth. In presenting our material in the table, the standard deviation was not taken into account.

*Table 5.*

The average number of all permanent teeth (except third molars) erupted into the mouth at specified chronological ages. 8333 boys and girls from 10 communities in Hungary.

| Next birthday | Average number of all permanent teeth (except third molars) in | |
|---|---|---|
| | boys | girls |
| 7th | 4,59 | 5,45 |
| 8th | 7,61 | 8,81 |
| 9th | 10,81 | 11,67 |
| 10th | 12,95 | 13,74 |
| 11th | 15,51 | 17,74 |
| 12th | 20,02 | 21,72 |
| 13th | 23,62 | 25,28 |
| 14th | 26,22 | 26,76 |

Finally, we have to put the question whether or not the teeth form a reliable criterion for judging biologically age and maturity of children. Paying full consideration to the items discussed, neither the eruption of any specified tooth at any specified age, nor the number of all erupted teeth seems an age criterion more reliable than any other hitherto used.

## *Summary.*

Data on the eruption of the permanent teeth in 8,333 children from Hungary are given. They have been compared with similar data from other regions of the world. The reliability of the permanent teeth as a test of age has been briefly discussed.

## *Résumé.*

Données relatives à la seconde dentition chez 8.333 enfants de la Hongrie. Une comparaison est faite avec des données pareilles d'autres régions du monde. Discussion de la possibilité d'utiliser l'évolution de la seconde dentition comme mesure de l'âge.

## *Zusammenfassung.*

Angegeben sind die Daten für den Durchbruch des Dauergebisses bei 8 333 Kindern von Ungarn. Sie sind mit gleichartigen Daten von anderen Gegenden der Welt verglichen worden. Die Zuverlässigkeit des Dauergebisses als Maßstab für das Alter ist kurz besprochen worden.

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# MONTH OF BIRTH AND ABILITIES

By H. J. STUTVOET, Amsterdam

Several investigators have tried to answer the question if the month of birth of man bears on his intelligence. A few times this answer has been affirmative but in most cases it has not been possible to give a definite answer.

One of the first investigators was *Blonsky* [1]. He drew his conclusions from the single fact, that out of 265 children that missed their remove at school there were twice as many born in autumn (October–December) as born in spring (March–May), while the times of birth of 246 "normal" children were rather regularly distributed over the year. Moreover he found with 453 children that those of March–May had a higher Intell. Quotient (I.Q.) than those of October–December. But such numbers are too small to allow any conclusion, while moreover there are no figures to decide if there are significant differences between the material examined and a random sample from a general population.

*Brander* [2] is very sceptical with respect to the relation between oligophrenia in children and their month of birth. His investigation includes only 613 oligophrenics, 1178 slightly oligophrenics and 1485 normal Finnish children. Since the distribution of the normal children over the different months deviates entirely from the course of births in Finland and also the material to be examined shows too many ups and downs, the numbers seem to be too small to arrive at any safe conclusion.

In this connection we want to mention the investigations of *Tramer* [3], *von Steiger* [4] and *Lang* [5], but as these studies refer to mental defects and not to the intelligence we will put them aside here, although the numbers used afford a greater scope owing to their extensiveness.

More in agreement with this paper are the investigations of *Pintner* and *Forlano* [6–9]. They classified 17.502 children from New-York c.a. according to their I.Q.'s and to their month of birth. They compared the course of the birthrates of the children with that of the population of the U.S.A. over 1915–28 and they found the correlation rather good. However, we do not agree with their opinion.

In a previous paper we denounced the possibility to fit a com-

posed sinusoide to the birth distribution diagram [10]. This allows a more exact comparison and it appears from it that the birth rhythm of the children is quite different for the various parts of the U.S.A. and even in these parts there is a difference between the rhythms of the cities and the rural districts.

As an illustration we give the parameters of the birth rhythms in four parts of the U.S.A. As part 1 we take Florida; as part 2 Texas and Louisiana; part 3 consists of Nebraska, Dakota, Minnesota and Wisconsin and part 4 of Ohio and Pennsylvania.

| U.S.A. | cities > 10.000 inh. | | | | rural districts | | | |
|---|---|---|---|---|---|---|---|---|
| | A | $\alpha$ | B | $\beta$ | A | $\alpha$ | B | $\beta$ |
| 1938 part 1 | 1.10 | –205 | 0.51 | 8 | 0.95 | –224 | 0.58 | –2 |
| 1938 part 2 | 1.17 | –184 | 0.66 | 18 | 0.46 | –201 | 0.64 | 9 |
| 1938 part 3 | 0.30 | – 88 | 0.31 | 15 | 0.32 | – 79 | 0.32 | 7 |
| 1938 part 4 | 0.24 | – 90 | 0.38 | 15 | 0.28 | – 39 | 0.35 | 5 |

The comparative figures of *Pintner* and *Forlano* contain 1.607.500 live births of the U.S.A. in 1915–28, whose rhythm can be given by the parameters

| | A | $\alpha$ | B | $\beta$ |
|---|---|---|---|---|
| U. S. A. 1915–28 | 0.22 | – 52 | 0.27 | – 1 |

For the 17.502 children we find

| A | $\alpha$ | B | $\beta$ |
|---|---|---|---|
| 0.24 | 3 | 0.53 | 9 |

so that we cannot consider this group of children quite representative of the U.S.A. But this is not necessary either, for the children are all from New-York and its surroundings so that we need other comparative figures viz. those of the big cities of the state of New-Yersey. Better comparative figures we find therefore in the following table:

| | | | A | $\alpha$ | B | $\beta$ |
|---|---|---|---|---|---|---|
| New-Jersey 1938 | | cities > 10.000 inh. | 0.34 | –131 | 0.37 | 20 |
| New-Jersey<br>Conn. Mass.<br>Delaw. Maryl.<br>Rhode Isl.<br>together | 1938 | cites > 10.000 inh. | 0.35 | –81 | 0.43 | 17 |
| | | cities: 2.500–10.000 inh. | 0.35 | –104 | 0.35 | 5 |
| | | rural districts | 0.21 | –30 | 0.44 | 7 |

As the parameters of the birth rhythm of the 17.502 children also deviate from the above parameters, especially as regards $\alpha$, we dare say without further test that these 17.502 children are not representative of the population. A further subdivision of these children will therefore give even less reliable results. Nevertheless we have taken the trouble of computing the fitting curves for each of the subgroups. The results are to be found in the following table:

| Number of children | | A | $\alpha$ | B | $\beta$ | goodness of fit |
|---|---|---|---|---|---|---|
| 4960 high I.Q. | | 0.52 | −82 | 0.25 | −14 | bad |
| 4523 moderate I.Q. | | 0.43 | 5 | 0.63 | 3 | rather good |
| 8019 low I.Q. | | 0.40 | 53 | 0.74 | 17 | very good |
| 5586 high | social standard | 0.35 | −40 | 0.42 | −9 | bad |
| 4171 mod. | social standard | 0.50 | 39 | 0.48 | 10 | bad |
| 7745 low | social standard | 0.14 | 13 | 0.70 | 16 | good |

It is striking, that with an increase of the values of the I.Q. the A-value increases and the $\alpha$-, B- and $\beta$-values decrease. Although less striking this phenomenon also appears when we subdivide the children according to their social level. This would affirm the statement that the social standard and I.Q. are correlated.

We believe the I.Q. to be a criterion not sufficiently sharp to reveal differences, if any, at the time of birth. A high I.Q. does not imply that the child will become an eminent man later on and on the other hand the abilities of many a man have developed during and after the age of puberty.

It is therefore better to examine the months of births of those men who are generally acknowledged as eminent on some subject. *Pintner* and *Forlano* made investigations in this direction too in their later paper. In this they give the months of birth of 12.274 men from "Who's Who in America" (which seems to us a less convincing material) but also of 8.917 American men of Science and 1.374 eminent men to bring to light the differences more clearly. But they could not draw any conclusion.

We have expressed the birth rhythms of these groups in parameters. To draw comparisons we should know the birth rhythm of the American population for the second half of the last century but as we do not know these figures, we have to use recent data, hoping that they will not differ too much.

| Number | Group | A | $\alpha$ | B | $\beta$ | Coeff. of corr. between obs. and comp. |
|---|---|---|---|---|---|---|
| 12.274 | Who's who | 0.41 | –175 | 0.37 | –17 | 0.8132 significant |
| 8.917 | Men of Sc. | 0.09 | –150 | 0.38 | – 4 | 0.7813 ,, |
| 1.374 | Emin. Men | 0.86 | 83 | 0.72 | – 3 | 0.9296 ,, |
| U.S.A. 1933-40 | North East | 0.34 | – 67 | 0.26 | 18 | 0.9654 ,, |
| | West | 0.32 | – 83 | 0.15 | 13 | 0.9966 ,, |
| | North C. | 0.22 | – 98 | 0.35 | 14 | 0.9799 ,, |
| | South | 0.13 | –167 | 0.52 | 6 | 0.9793 ,, |
| U.S.A. 1933–40 | | 0.17 | – 89 | 0.36 | 9 | 0.9845 ,, |

As the coefficients of correlation between observed and computed rhythms are high and significant we may look upon the parameters as determinative for each group. We expect, that the three groups collected by *Pintner* and *Forlano* show a larger deviation in the parameters from those of the population according to the stricter selection of the group as regards intelligence.

With respect to A, this is high for the first and the third group but extremely low for the second group. Parameter $\alpha$ shows an increase from –175 to 83 but only for the third group. $\alpha$ is greatly deviating from that of the average population. B shows an increase when eminence increases. As the fluctuations of $\beta$ are very slight, we need not consider it. The numbers seem to us too small to consider $\alpha$ and B as criteria for intelligence.

Referring to the above we also wish to point out that the months of birth of 1.411 musicians from North America, as collected by us, show a rhythm with the following parameters:

| A | $\alpha$ | B | $\beta$ | coeff. of corr. |
|---|---|---|---|---|
| 0.84 | 109 | 0.26 | 7 | 0.8532 significant |

When we compare the birth curves of these four groups of North Americans we see a decrease of the second birth maximum of September, which generally occurs rather strongly in the U.S.A. and an increase of the first birth maximum with a simultaneous shifting from March to January (fig. 1).

We have directed our investigations at several kinds of special abilities and we confined ourselves in the first place to the months of birth of musicians.

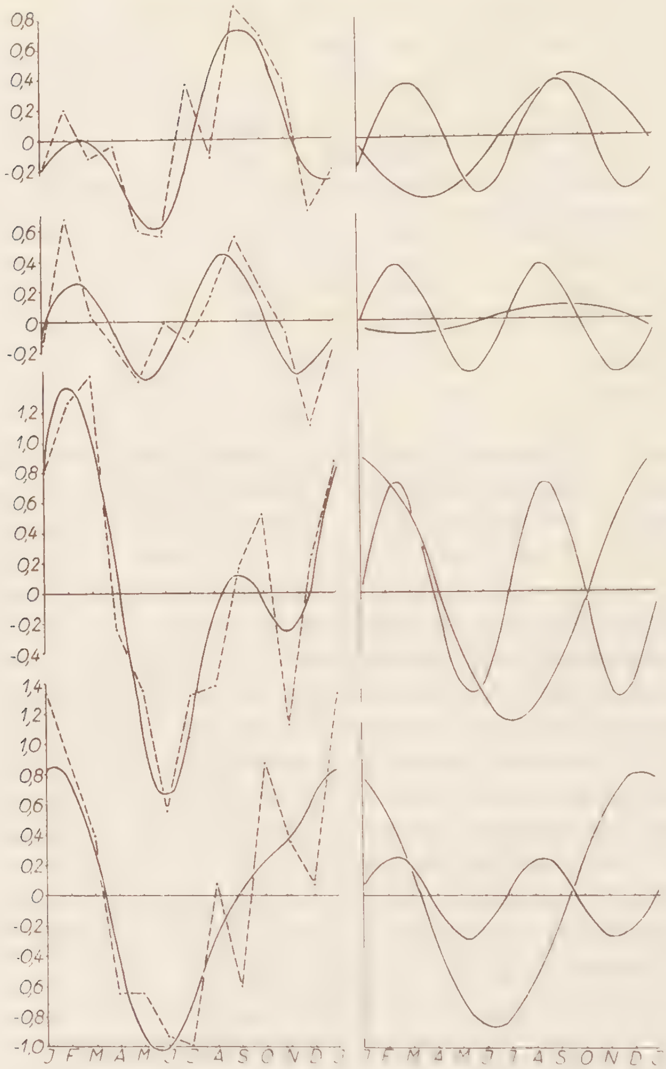


*Fig. 1.* At the left side the four birth frequency curves of wellknown Americans, American Scientists, eminent Americans and American musicians respectively are given. At the right the same birth frequency curves decomposed in their two rhythms.

The MacMillan Encyclopedia of Music and Musicians [11] has given us 11.996 musicians from Western Europe. 1.437 from Southern Europe, 1.707 from Eastern Europe and the 1.411 from North America mentioned above.

The 11.996 musicians from Western Europe are distributed with respect to their month of birth as follows:

| Number of month | Number | Perc. | Corrected percent. | Computed percent. |
|---|---|---|---|---|
| 1 | 1.128 | 9.39 | 9.21 | 9.20 |
| 2 | 1.052 | 8.76 | 9.50 | 9.44 |
| 3 | 1.130 | 9.42 | 9.23 | 9.21 |
| 4 | 1.066 | 8.88 | 8.95 | 8.82 |
| 5 | 980 | 8.17 | 8.01 | 8.20 |
| 6 | 926 | 7.72 | 7.82 | 7.71 |
| 7 | 919 | 7.66 | 7.51 | 7.46 |
| 8 | 892 | 7.43 | 7.30 | 7.46 |
| 9 | 923 | 7.69 | 7.79 | 7.59 |
| 10 | 933 | 7.78 | 7.64 | 7.84 |
| 11 | 993 | 8.28 | 8.39 | 8.22 |
| 12 | 1.054 | 8.78 | 8.61 | 8.71 |
| Total | 11.996 | 99.96 | 99.96 | 99.86 |

The fourth column "corrected percentages" contains the percentages for 12 "months" of 30.42 days each. The coefficient of correlation between observed and computed percentages is $0.9822 \pm 0.0054$ and appears to be very significant after testing.

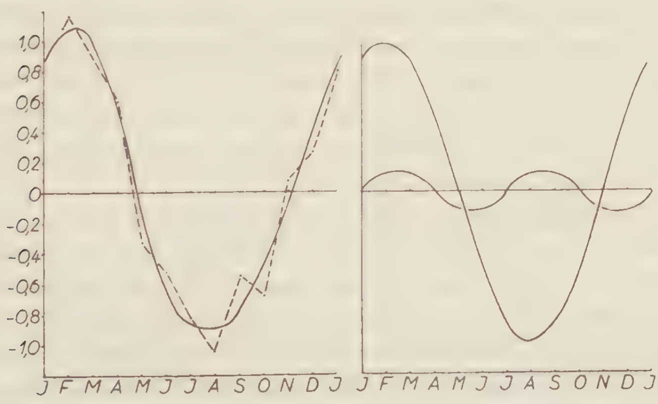


*Fig. 2.* The birth rhythm of 11.996 musicians from Western Europe.

The computed percentages give a rhythm (fig. 2) with the parameters:

| A | $\alpha$ | B | $\beta$ |
|---|---|---|---|
| 1.00 | 60 | 0.14 | 1 |

Now we must choose our comparative material. In the "Aperçu de la démographie des divers pays du monde. 1929–36" [12] we find the vital statistics for this century. The following rhythms are important to be mentioned here:

| Country | Period | A | $\alpha$ | B | $\beta$ |
|---|---|---|---|---|---|
| France . . . . . . . | 1929–36 | 0.50 | – 2 | 0.28 | 13 |
| Germany . . . . . . | 1929–36 | 0.56 | 9 | 0.21 | 1 |
| Belgium . . . . . . | 1929–36 | 0.57 | 1 | 0.27 | 7 |
| Netherland . . . . . | 1929–36 | 0.34 | – 7 | 0.29 | 4 |
| Denmark . . . . . | 1929–35 | 0.66 | – 2 | 0.34 | – 8 |
| Scotland . . . . . . | 1929–36 | 0.55 | – 5 | 0.03 | –60 |
| Norway . . . . . . | 1929–35 | 0.85 | – 9 | 0.34 | –13 |
| Sweden. . . . . . . | 1929–35 | 0.59 | –15 | 0.20 | –16 |
| Switzerland . . . . | 1931–40 | 0.72 | 5 | 0.32 | – 2 |
| Italy . . . . . . . . | 1929–36 | 0.69 | 69 | 0.49 | 6 |
| Spain . . . . . . . | 1929–34 | 0.92 | 41 | 0.25 | 4 |
| Portugal . . . . . . | 1929–36 | 0.76 | 58 | 0.37 | – 1 |

For the whole of Western Europe there are no great differences between the parameters, except for Scotland, where the very low value of B also makes the deviating value of $\beta$ less reliable. The great difference between Western and Southern Europe finds its expression, besides faintly in A, especially in $\alpha$. As the musicians included in our statistics were mainly born in the second half of the nineteenth century, it should be safe to consider also the birth rhythms of Europe of that time.

The most important data, that are at our disposal, consist of the tables of *Mayr*, cited by *Ploss* [13]. These give the numbers of live and still births together per month for Germany (1872–75), Bavaria (1872–75), France (1863–71) and Italy (1863–71). Further *Sanders* [14] gives the legitimate births of Prussia (1886–95). *Lang* [5] 2.250.011 births in Bavaria (1905–14) and 17.379 hospitalized patients and *von Steiger* [4] the table of Switzerland (1871–80).

For the end of the past century we find some data in "Statistik des Deutschen Reiches" [15].

The computed rhythms may be expressed by the following parameters:

| Country | Period | A | $\alpha$ | B | $\beta$ |
|---|---|---|---|---|---|
| France . . . . . . | 1863–71 | 0.70 | 43 | 0.41 | – 2 |
| Italy . . . . . . | 1863–71 | 0.79 | 67 | 0.55 | – 6 |
| Germany . . . . . | 1872–75 | 0.30 | 92 | 0.35 | – 4 |
| Bavaria . . . . . | 1872–75 | 0.29 | 41 | 0.24 | – 7 |
| Prussia . . . . . | 1886–95 | 0.26 | 108 | 0.27 | – 5 |
| Switzerland . . . | 1871–80 | 0.20 | –17 | 0.15 | – 3 |
| France . . . . . . | about 1890 | 0.43 | 31 | 0.26 | –14 |
| Italy . . . . . . . | ,, ,, | 0.56 | 59 | 0.42 | –10 |
| Germany . . . . . | ,, ,, | 0.24 | 90 | 0.28 | – 9 |
| Sweden. . . . . . | ,, ,, | 0.35 | 60 | 0.25 | –27 |
| Austria . . . . . | ,, ,, | 0.34 | 42 | 0.21 | –12 |
| Bavaria (17.379 pat.) | | 0.56 | 29 | 0.29 | – 3 |
| Bavaria . . . . . | 1905–14 | 0.33 | – 3 | 0.26 | 0 |

Comparing these tables with the preceding ones we see that in the course of the period 1860 to 1940 only a change in $\alpha$, but a very important one, occurred for Western Europe. For Italy this is not the case and also for Switzerland we did not find this phenomenon in our previous paper [10].

This shifting of $\alpha$ has been further confirmed by statistical data from Berlin for the months of birth of children born after the second child. The rhythms found herewith are:

| | | A | $\alpha$ | B | $\beta$ |
|---|---|---|---|---|---|
| Berlin after | 1879–1889 | 0.33 | 112 | 0.25 | 15 |
| the second | 1890–1901 | 0.28 | 79 | 0.20 | 19 |
| child | 1901–1913 | 0.40 | 38 | 0.27 | 24 |

So it is better to compare the month of birth of musicians with the birth rhythms of Western Europe in the second half of the past century. If we could combine the countries of Western Europe we

do not believe that $\alpha$ of the musicians will deviate much from that of the general population. The same holds for $\beta$. The parameter A is considerably higher for musicians and B is lower than in the general population. For the musicians the B-rhythm is faint so that the birth curve is hardly a common sinusoïde. The times of birth of these musicians are therefore stronger concentrated on the time of the February maximum.

Though less reliable on account of the smaller number, we want to compare here the rhythm for 1437 musicians from Southern Europe (Italy, Spain and Portugal) and that of the general Italian population (1863–71).

| | A | $\alpha$ | B | $\beta$ |
|---|---|---|---|---|
| 1437 mus. Southern Europe . . . . . | 2.05 | 77 | 0.77 | 0 |
| Italy 1863–71 . . . . . . . . . . | 0.79 | 67 | 0.55 | –6 |

It is confirmed that for musicians A is considerably higher than normal but not that B is lower[1]).

Yet we are supported in our statement by the provisional results of an analogous investigation, which is not yet finished but extends over other groups of eminent men. The provisional results are:

| Kind | Number | A | $\alpha$ | B | $\beta$ |
|---|---|---|---|---|---|
| Scientists [16] . . . . | 3239 | 1.49 | 57 | 0.14 | –16 |
| Plastic Artists [17] . . | 1944 | 0.75 | 80 | 0.20 | 8 |
| Literary Men [18] . . . | 2294 | 1.46 | 77 | 0.67 | –9 |
| Physicians [19] . . . . | 4447 | 0.63 | 18 | 0.27 | 15 |

Probably the conclusion will be: for scientists, plastic artists and musicians there is a very strong birth maximum in February

[1]) Finally it may be remembered that as said in a previous paper by the present author, it is the business of the statistician to find out the facts but that of the biologist to interpret these facts. Nevertheless I wish to point out that the results of the present paper seem to be that parents of children who happen to have musical ability have their fertility in a certain rhythm. It does not appear probable, however, that children born at a certain time of the year are more musical for that reason than children born at other times.

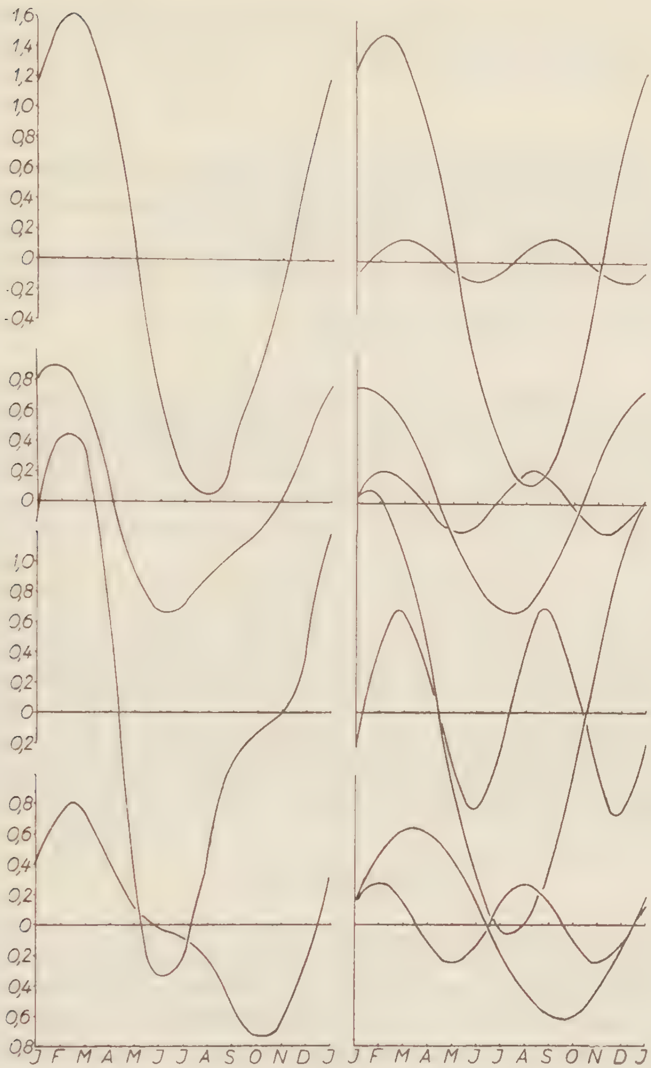


*Fig. 3.* The birth frequency curves of scientists, plastic artists, literary men and physicians (Western Europe).

(fig. 3) and also for literary men the two-top curve has disappeared and there is only one maximum in February, but the B-rhythm has yet a rather strong influence, probably because a literary man does not want such a special ability as a musician and a mathematician. This would hold even stronger for a physician. It agrees with the

phenomenon mentioned above that $a$ for the physicians is very low, because these physicians are from more recent time than the other groups.

*Summary.*

In this paper we have tried to contribute to the solution of the problem if eminence and month of birth are correlated. For that purpose we applied a new method, giving the rhythm of births in parameters. The method has been applied to the months of birth of about 12.000 musicians.

*Résumé.*

Dans cet article-ci nous avons essayé à contribuer à la résolution du problème, s'il y a de la correlation entre les mois de naissance et l'éminence des hommes. Nous avons appliqué une nouvelle méthode, qui donne le rhythme des naissances en paramètres. La méthode a été appliquée aux mois de naissances d'environ 12.000 musiciens.

*Zusammenfassung.*

Der vorliegende Artikel stellt den Versuch eines Beitrages zur Lösung des Problemes, ob zwischen Stellung und Geburtenmonat eine Korrelation besteht, dar. Wir haben eine neue Methode zur Anwendung gebracht, welche den Geburtenrhythmus in Parametern wiedergibt. Diese Methode ist auf die Geburtenmonate von rund 12 000 Musikern angewendet worden.

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# EFFICACITÉ DE L'INDICE CRÂNIEN ET DE L'INDICE NASAL COMPARÉE À L'ANALYSE DISCRIMINANTE

Par A. A. WEBER, Genève.

Dans de nombreux domaines et en particulier en anthropologie, les individus étudiés sont fréquemment caractérisés par un nombre plus ou moins grand de mesures différentes. Peut-on analyser de telles données en tenant compte simultanément de l'ensemble de ces mesures ?

Différentes méthodes statistiques, désignées communément sous le nom de « multi-variate analysis » permettent de résoudre un grand nombre de problèmes du type précédent. Parmi ces dernières, je citerai le « cœfficient of racial likeness » de *K. Pearson* [1926] comme premier en date, la distance généralisée de *P. C. Mahalanobis* [1928] reprise par *R. C. Bose* et par *S. N. Roy* [1935 et 1937], le rapport généralisé de Student de *H. Hotelling* [1931] et l'analyse discriminante de *R. A. Fisher* [1934].

C'est cette dernière méthode que je voudrai brièvement relater ici.

### *L'analyse discriminante de R. A. Fisher.*

Cette méthode permet de distinguer différents groupes d'individus, puis, ce premier pas étant effectué, de classer avec une grande sécurité un individu mesuré ultérieurement ou de provenance douteuse.

Soient n individus répartis en c classes d'effectifs respectifs $n_1$, $n_2, \ldots, n_c$ avec $n_1 + n_2 + \ldots + n_c = n$ et $x^1, x^2, \ldots, x^p$ l'ensemble des mesures effectuées sur chaque individu. Le but de l'analyse discriminante est de trouver une combinaison linéaire

$$X = \lambda_1 x^1 + \lambda_2 x^2 + \ldots + \lambda_p x^p \qquad (1)$$

des p mesures où les $\lambda i$ sont déterminés de manière telle que les variations de X d'une classe à l'autre soient aussi grandes que pos-

sible par rapport aux différences de X entre individus d'une même classe, ce que l'on exprime statistiquement en rendant maximum le rapport de la variance de X entre les classes à celle de X à l'intérieur des classes, ou ce qui revient au même, en cherchant le maximum de $\varrho$ qui lui est proportionnel.

$$\varrho = \frac{\text{Somme des carrés de X entre les classes}}{\text{Somme des carrés de X à l'intérieur des classes}} \tag{2}$$

*Exemple: Longueur et largeur du crâne.*

On a tiré des fiches du professeur *Schlaginhaufen* relatives aux cantons d'Appenzell et de Saint-Gall les quantités

x = longueur maximale du crâne moins 140 mm.

y = largeur maximale du crâne moins 140 mm.

Ces fiches portaient sur 3 572 recrues réparties entre 14 régions (voir tableau 4).

On se propose d'étudier comment ce couple de mesures varie d'une région à l'autre.

L'équation (1) se réduit alors à:

$$X = \lambda_1 x + \lambda_2 y \tag{1'}$$

Si $x_{am}$ et $y_{am}$ représentent la longueur et la largeur maximale du crâne de l'individu $a$ ($a = 1, 2, \ldots, n_m$) de la $m^{\text{ième}}$ classe ou région ($m = 1, 2, \ldots, 14$), E la somme des carrés de X entre les régions et D, la somme des carrés de X à l'intérieur des régions, il vient:

$$E = \sum_{m=1}^{14} n_m (\bar{X}_m - \bar{X})^2 = \sum_{m=1}^{14} n_m \left[ \lambda_1 (\bar{x}_m - \bar{x}) + \lambda_2 (\bar{y}_m - \bar{y}) \right]^2$$

ou, en posant:

$$E_{xx} = \sum_{m=1}^{14} n_m (\bar{x}_m - \bar{x})^2, \; E_{xy} = \sum_{m=1}^{14} n_m (\bar{x}_m - \bar{x}) (\bar{y}_m - \bar{y}) \;,$$

$$E_{yy} = \sum_{m=1}^{14} n_m (\bar{y}_m \; \bar{y})^2; \quad E = \lambda_1^2 E_{xx} + 2\lambda_1\lambda_2 E_{xy} + \lambda_2^2 E_{yy} \tag{3}$$

$$D = \sum_{m=1}^{14} \sum_{a=1}^{Nm} X(am - \bar{X}m)^2 = \sum_{m=1}^{14} \sum_{a=1}^{Nm} \left[ \lambda_1 (x_{am} - \bar{x}_m) + \lambda_2 (y_{am} - \bar{y}_m) \right]^2$$

ou, en posant:

$$\mathrm{Dxx} = \sum_{m=1}^{14} \sum_{a=1}^{Nm} (x_{am} - \bar{x}_m)^2 , \; D_{xy} = \sum_{m=1}^{14} \sum_{a=1}^{Nm} (x_{am} - \bar{x}_m) \, (y_{am} - \bar{y}) \; ,$$

$$D_{yy} = \sum_{m=1}^{14} \sum_{a=1}^{Nm} (\bar{y}_{am} - \bar{y}_m)^2$$

$$D = \lambda_1^2 D_{xx} + 2\lambda_1\lambda_2 \, D_{xy} + \lambda_2^2 D_{yy} \tag{4}$$

Pour que $\varrho = \dfrac{E}{D}$ soit maximum, il faut que ses dérivées premières par rapport aux $\lambda_i$ soient toutes nulles.

$$\frac{\delta \varrho}{\delta \lambda_i} = \frac{D \dfrac{\delta E}{\delta \lambda_i} - E \dfrac{\delta D}{\delta \lambda_i}}{D^2} = 0$$

ou, ce qui revient au même:

$$\frac{\delta E}{\delta \lambda_i} - \varrho \frac{\delta D}{\delta \lambda_i} = 0 \qquad (i = 1, \; 2)$$

En tenant compte de (3) et de (4), les deux équations précédentes deviennent:

$$\begin{aligned} \lambda_1 \, (E_{xx} - \varrho D_{xx}) + \lambda_2 \, (E_{xy} - \varrho D_{xy}) = 0 \\ \lambda_1 \, (E_{xy} - \varrho D_{xy}) + \lambda_2 \, (E_{yy} - \varrho D_{yy}) = 0 \end{aligned} \tag{5}$$

Le système (5) est formé de deux équations linéaires homogènes en les deux inconnues $\lambda_1$ et $\lambda_2$. Pour qu'il admette une solution différente de zéro, il faut que son déterminant soit nul.

$$\begin{vmatrix} E_{xx} - \varrho D_{xx} & E_{xy} - \varrho D_{xy} \\ E_{xy} - \varrho D_{xy} & E_{yy} - \varrho D_{yy} \end{vmatrix} = 0 \tag{6}$$

ou

$$\varrho^2 \begin{vmatrix} D_{xx} & D_{xy} \\ D_{xy} & D_{yy} \end{vmatrix} - \varrho \left[ \begin{vmatrix} E_{xx} & D_{xy} \\ E_{xy} & D_{yy} \end{vmatrix} + \begin{vmatrix} D_{xx} & E_{xy} \\ D_{xy} & E_{yy} \end{vmatrix} \right] + \begin{vmatrix} E_{xx} & E_{xy} \\ E_{xy} & E_{yy} \end{vmatrix} = 0 \tag{6'}$$

avec (cf. tableau 4)

$$\begin{aligned} D_{xx} &= 165\,820{,}437 & D_{xy} &= 36\,937{,}733 & D_{yy} &= 115\,489{,}489 \\ E_{xx} &= 2\,126{,}328 & E_{xy} &= -293{,}383 & E_{yy} &= 1\,389{,}576 \end{aligned}$$

En portant ces valeurs dans (6'), il vient:

$$(100\varrho)^2 \cdot 1\,778\,612 \; - (100\varrho) \cdot 4\,976\,624 \; + 2\,868\,621 = 0$$

ou

$$(100\varrho)^2 \; - 2{,}798\,038 \cdot (100\,\varrho) \; + 1{,}612\,842 \; = 0$$

On en tire:

$\varrho_1 = 0{,}019\,858\,85$ meilleure discrimination

$\varrho_2 = 0{,}008\,121\,53$ moins bonne discrimination

En remplaçant dans le système (5) $\varrho$ par 0,019 858 85, on détermine $\lambda_1$ et $\lambda_2$ à un facteur multiplicatif près.

$$1\,166{,}676\,\lambda_1 + 1\,026{,}924\,\lambda_2 = 0$$

$$1\,026{,}924\,\lambda_1 + 903{,}913\,\lambda_2 = 0$$

En posant $\lambda_1 = 1{,}000\,000$ on obtient pour $\lambda_2$ la valeur $-0{,}880\,214$ et finalement:

$$X = 1{,}000\,000\,x - 0{,}880\,214\,y$$

On trouve à la dernière colonne du tableau 4 les valeurs moyennes de X pour chaque région.

L'efficacité d'une analyse discriminante se mesure au moyen d'un test de F comme le montre le tableau 1.

| | d. l. | Somme des carrés | Carré moyen | F |
|---|---|---|---|---|
| meilleure discrimination | 14 | 0,019 859 | 0,001 418 5 | 5,046 |
| moins bonne discrimination | 12 | 0,008 122 | 0,000 676 8 | 2,408 |
| somme | 26 | 0,027 980 | | |
| à l'intérieur des régions | 3 557 | 1,000 000 | 0,000 281 1 | |

*Tableau 1.* Efficacité de l'analyse discriminante.

La meilleure discrimination est significative à $1^0/_{00}$ alors que la moins bonne l'est encore à 1 %.

Géométriquement, le problème peut se concevoir de la manière suivante. Trouver dans le plan des x y une droite d telle que la projection des vecteurs représentants chaque individu sur d montre les plus grands écarts possibles entre les régions par rapport à ceux à l'intérieur des régions.

En effet, en posant

$$\cos\Theta = \frac{\lambda_1}{\sqrt{\lambda_1^2 + \lambda_2^2}}$$

$$\sin\Theta = \frac{\lambda_2}{\sqrt{\lambda_1^2 + \lambda_2^2}}$$

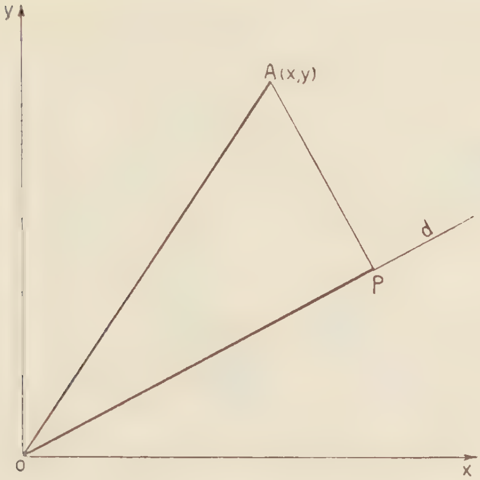


*Fig. 1.*

l'équation (1') $X = \lambda_1 x + \lambda_2 y$ peut s'écrire:

$$X = \sqrt{\lambda_1^2 + \lambda_2^2}\ (x \cos \Theta + y \sin \Theta)$$

C'est, au facteur $\sqrt{\lambda_1^2 + \lambda_2^2}$ près, la projection $\overline{OP}$ de $\overline{OA}$ sur la droite d d'équation $y = \frac{\lambda_2}{\lambda_1} x$. (cf. fig. 1).

Le fait que d passe par l'origine ou non ne joue aucun rôle, l'analyse discriminante ne tenant compte que de la position relative des points A.

En donnant à $\lambda_1$ et $\lambda_2$ les valeurs trouvées pour la meilleure discrimination, la pente de d s'élève à – 0,880 214. Sur la figure 2 on a projeté les moyennes par région sur la droite de meilleure discrimination. L'ordre de projection coïncide bien avec celui trouvé dans le tableau 4.

### *Comparaison avec l'indice crânien.*

L'indice crânien n'est pas une combinaison linéaire des deux variables x et y, on peut cependant tenter de le représenter par une relation du type (1') ($X = \lambda'_1 x + \lambda'_2 y$). Dans la figure 3, en interceptant le faisceau des droites qui joignent les points M à l'origine par une droite d de pente quelconque, on détermine sur d un faisceau de points M'. Les distances d'un point M' à l'autre sont proportionnelles aux différences de pentes entre les droites correspondantes, et

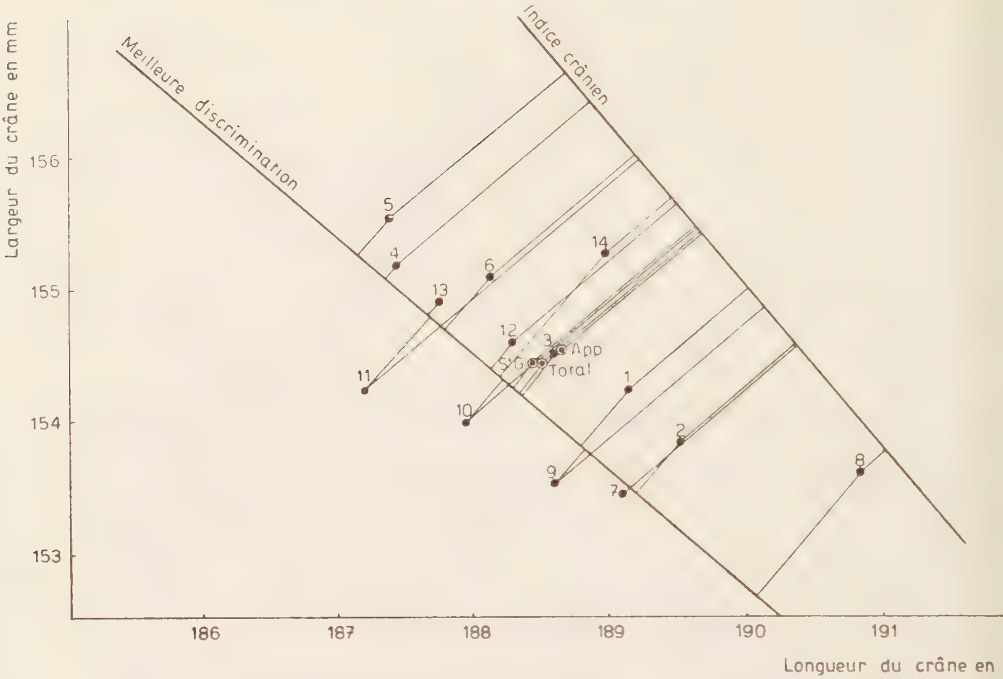


*Fig. 2.*

par la aux différences entre les indices correspondants. Si ce faisceau de droites diverge peu, on pourra le remplacer en première approxi-

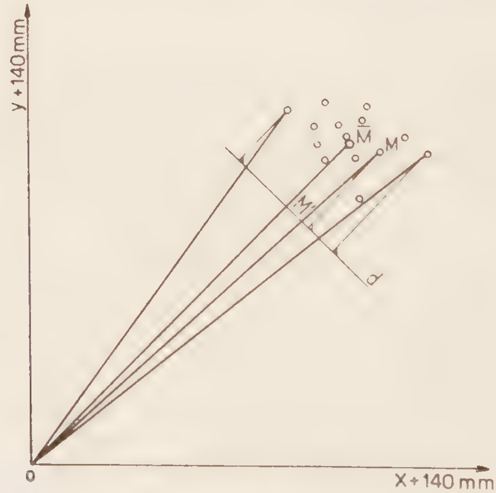


*Fig. 3.*

mation par un faisceau de parallèles passant par les points M et de pente égale à la pente moyenne $\frac{\bar{y} + 140}{\bar{x} + 140}$ du faisceau.

En choisissant d perpendiculaire à $\overline{OM}$, on peut remplacer l'indice crânien par $X' = (\bar{y} + 140)\,x - (\bar{x} + 140)\,y$ qui est la relation du type (1') cherchée. On trouve dans le tableau 4 $\bar{x} = 48{,}492$, $\bar{y} = 14{,}408$ . X' devient finalement:

$$X' = 154{,}408\,x - 188{,}492\,y$$

ou, en divisant les deux membres par 154,408.

$$X^* = 1{,}000\,000\,x - 1{,}220\,740\,y$$

L'efficacité relative de l'indice crânien peut finalement être estimée par le carré du coéfficient de corrélation entre X et X* à l'intérieur des régions.

$$R^2 = \frac{\{\lambda_1 \lambda'_1 D_{xx} + (\lambda_1 \lambda'_2 + \lambda_2 \lambda'_1) D_{xy} + \lambda_2 \lambda'_2 D_{yy}\}^2}{\{\lambda_1^2 D_{xx} + 2\,\lambda_1 \lambda_2 D_{xy} + \lambda_2^2 D_{yy}\}\{\lambda'^2_1 D_{xx} + 2\,\lambda'_1 \lambda'_2 D_{xy} + \lambda'^2_2 D_{yy}\}} \quad (7)$$

et dans ce problème:

$$R^2 = \frac{(212\,310{,}85)^2}{(190\,272{,}78)\,(247\,740{,}85)} = 0{,}956 \cong 95{,}6\,\%$$

*Largeur et hauteur du nez.*

Une analyse en tout point semblable à la précédente a été effectuée sur les variables

x = largeur du nez en mm
y = hauteur du nez en mm.

En employant la même notation que précédemment, on obtient (voir tableau 5):

$$D_{xx} = 23\,051{,}89 \qquad D_{xy} = 1\,223{,}06 \qquad D_{yy} = 63\,736{,}86$$
$$E_{xx} = 419{,}53 \qquad E_{xy} = 207{,}27 \qquad E_{yy} = 562{,}94$$

La formule (6') devient

$$(100\varrho)^2 - 2{,}671\,375\;.\;(100\varrho) + 1{,}316\,356 = 0$$

et admet pour solutions

$\varrho_1 = 0{,}020\,195\,8$ meilleure discrimination

$\varrho_2 = 0{,}006\,518\,0$ moins bonne discrimination

En portant la valeur de $\varrho_1$ dans le système (5) et en posant

$\lambda_1 = 1{,}000\,000$ on trouve $\lambda_2 = 0{,}252\,070$ et finalement

$X = 1{,}000\,000\ x + 0{,}252\,070\ y$

La signification de cette discrimination apparaît dans l'analyse de la variance du tableau 2.

| | d. l. | S. C. | C. M. | F |
|---|---|---|---|---|
| meilleure discrimination | 14 | 0,020 196 | 0,001 442 6 | 5,103 |
| moins bonne discrimination | 12 | 0,006 518 | 0,000 543 2 | 1,921 |
| somme | 26 | 0,026 714 | 0,001 027 5 | 3,635 |
| à l'intérieur des régions | 3 544 | 1,000 000 | 0,000 282 7 | |

*Tableau 2.* Efficacité de l'analyse discriminante.

La meilleure discrimination est significative à 1 $^0/_{00}$ alors que la moins bonne ne l'est plus qu'à 5 %. Il s'ensuit que selon le choix des paramètres $\lambda_1$ et $\lambda_2$, les différences entre les régions apparaîtrons très distinctes, ou au contraire très peu.

On obtient la valeur de $\lambda_1$ et de $\lambda_2$ pour la moins bonne discrimination en portant la valeur de $\varrho_2$ dans le système (5). Il vient pour $\lambda_1 = 1{,}000\,000$ $\lambda_2 = -\,1{,}351\,143$ et par suite:

$1{,}000\,000\ x - 1{,}351\,143\ y$

### *Comparaison avec l'indice nasal.*

En cherchant à approximer l'indice nasal par une combinaison linéaire du type (1'), on obtient pour les paramètres $\lambda'_1$ et $\lambda'_2$

$$\lambda'_1 = 1{,}000\,000 \quad \lambda'_2 = -\frac{33{,}366}{53{,}579} = -\,0{,}622\,744$$

et

$X^* = 1{,}000\,000\ x - 0{,}622\,744\ y$

On remarque dans la figure 4 que l'indice nasal est plus près de la moins bonne discrimination que de la meilleure.

L'efficacité de l'indice nasal est donnée par la formule (7) et vaut $R^2 = 0{,}123\,72$ ou environ 12 %. On peut interpréter ce résultat en disant que l'on retire la même information en analysant 124 individus au moyen de l'analyse discriminante que 1 000 au moyen de l'indice nasal.

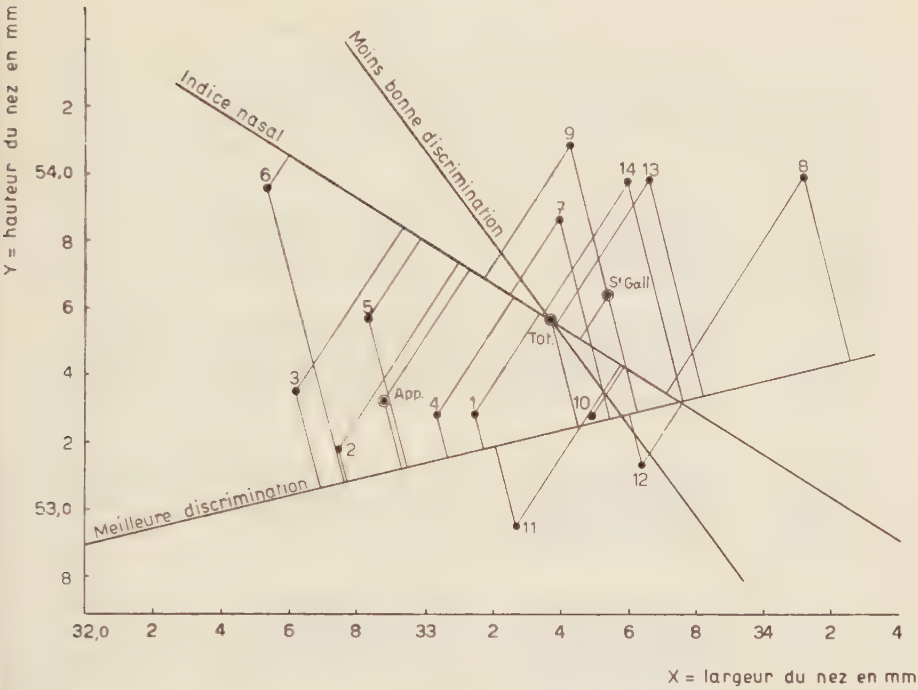


*Fig. 4.*

L'analyse de la variance effectuée sur l'indice nasal ou plus exactement sur X* montre que les régions sont différentes à 1 %.

| | d. l. | S. C. | C. M. | F |
|---|---|---|---|---|
| entre les régions | 13 | 379,4 | 29,21 | 2,238 |
| à l'intérieur des régions | 3 545 | 46 246,4 | 13,05 | |

***Tableau 3.*** **Analyse de la variance pour l'indice nasal.**

*Récapitulation.*

| Régions | n | $\bar{x}$ | $\bar{y}$ | $S(x-\bar{x})^2$ | $S(x-\bar{x})(y-\bar{y})$ | $S(y-\bar{y})^2$ | Discriminant X | Rang | Indice | Rang |
|---|---|---|---|---|---|---|---|---|---|---|
| *Appenzell* | | | | | | | | | | |
| 1 Hinterland | 272 | 49,136 | 14,202 | 12 547,967 | 2 192,519 | 7 505,879 | 36,635 | 10 | 81,530 | 10 |
| 2 Mittelland | 190 | 49,500 | 13,800 | 7 591,500 | 1 192,000 | 5 206,400 | 37,353 | 13 | 81,161 | 12 |
| 3 Vorderland | 208 | 48,625 | 14,466 | 11 390,750 | 2 367,375 | 6 709,765 | 35,892 | 9 | 81,891 | 9 |
| 4 Appenzell-Ort | 146 | 47,432 | 15,137 | 6 929,816 | 1 563,370 | 5 399,261 | 34,108 | 2 | 82,770 | 2 |
| 5 Innerer Landesteil | 77 | 47,377 | 15,494 | 2 628,078 | 444,689 | 2 935,247 | 33,793 | 1 | 82,985 | 1 |
| 6 Enclave Oberegg | 39 | 48,128 | 15,051 | 1 094,359 | 400,744 | 1 389,898 | 34,880 | 5 | 82,417 | 4 |
| Total | 932 | 48,642 | 14,468 | 42 736,305 | 7 786,249 | 29 410,034 | 35,907 | | 81,884 | |
| *St. Gallen* | | | | | | | | | | |
| 7 Bodensee | 160 | 49,100 | 13,438 | 5 028,400 | 1 420,000 | 5 293,375 | 37,271 | 12 | 81,141 | 13 |
| 8 St. Gallen Stadt | 106 | 50,821 | 13,575 | 5 025,595 | 917,934 | 3 425,897 | 38,872 | 14 | 80,482 | 14 |
| 9 Fürstenland | 293 | 48,601 | 13,495 | 15 690,280 | 2 335,902 | 9 475,243 | 36,723 | 11 | 81,386 | 11 |
| 10 Unteres Toggenburg | 535 | 47,927 | 13,957 | 27 578,158 | 5 676,324 | 18 620,012 | 35,626 | 8 | 81,924 | 8 |
| 11 Oberes Toggenburg | 257 | 47,198 | 14,202 | 13 026,880 | 3 310,681 | 8 303,479 | 34,697 | 4 | 82,374 | 5 |
| 12 Linthgebiet | 293 | 48,280 | 14,546 | 14 719,053 | 2 975,222 | 9 818,628 | 35,476 | 6 | 82,083 | 7 |
| 13 Walenseetal | 240 | 47,754 | 14,858 | 9 998,469 | 2 590,642 | 7 375,148 | 34,675 | 3 | 82,479 | 3 |
| 14 Rheintal | 756 | 48,966 | 15,205 | 32 571,106 | 9 550,331 | 24 031,221 | 35,582 | 7 | 82,134 | 6 |
| Total | 2 640 | 48,439 | 14,387 | 125 182,182 | 28 846,888 | 87 464,587 | 35,775 | | 81,929 | |
| *Appenzell + St. Gallen* | | | | | | | | | | |
| (Somme) | | | | 165 820,437 | 36 937,733 | 115 489,489 | | | | |
| (Entre les régions) | | | | 2 126,328 | – 293,383 | 1 389,576 | | | | |
| Total | 3 572 | 48,492 | 14,408 | 167 946,765 | 36 644,350 | 116 879,065 | 35,810 | | 81,918 | |

*Tableau 4.* Longueur et largeur maximale du crâne.

*Récapitulation.*

| Régions | n | $\bar{x}$ | $\bar{y}$ | $S(x-\bar{x})^2$ | $S(x-\bar{x})(y-\bar{y})$ | $S(y-\bar{y})^2$ | Discriminant X | Rang | Indice | Rang |
|---|---|---|---|---|---|---|---|---|---|---|
| *Appenzell* | | | | | | | | | | |
| 1 Hinterland | 272 | 33,143 | 53,298 | 1 529,41 | 514,39 | 5 498,88 | 46,578 | 6 | 62,184 | 8 |
| 2 Mittelland | 190 | 32,742 | 53,195 | 1 392,36 | 519,54 | 3 311,79 | 46,151 | 3 | 61,551 | 4 |
| 3 Vorderland | 207 | 32,614 | 53,357 | 1 085,08 | 34,60 | 3 545,55 | 46,063 | 1 | 61,124 | 2 |
| 4 Appenzell-Ort | 146 | 33,034 | 53,295 | 832,83 | 88,53 | 2 558,34 | 46,468 | 5 | 61,983 | 7 |
| 5 Innerer Landesteil | 76 | 32,829 | 53,579 | 350,78 | 45,23 | 1 244,53 | 46,335 | 4 | 61,272 | 3 |
| 6 Enclave Oberegg | 39 | 32,538 | 53,949 | 183,69 | – 58,92 | 681,90 | 46,137 | 2 | 60,313 | 1 |
| Total | 930 | 32,875 | 53,340 | 5 419,53 | 1 133,42 | 16 864,63 | 46,320 | | 61,633 | |
| *St. Gallen* | | | | | | | | | | |
| 7 Bodensee | 160 | 33,393 | 53,881 | 1 306,19 | – 36,52 | 3 144,74 | 46,974 | 9 | 61,975 | 6 |
| 8 St. Gallen Stadt | 105 | 34,114 | 54,010 | 864,63 | 25,89 | 1 866,99 | 47,728 | 14 | 63,050 | 13 |
| 9 Fürstenland | 293 | 33,423 | 54,106 | 1 915,52 | 286,88 | 5 189,72 | 47,061 | 11 | 61,773 | 5 |
| 10 Unteres Toggenburg | 536 | 33,479 | 53,291 | 3 445,78 | 393,20 | 9 874,60 | 46,912 | 8 | 62,823 | 12 |
| 11 Oberes Toggenburg | 256 | 33,266 | 52,961 | 1 531,94 | – 227,34 | 4 047,61 | 46,616 | 7 | 62,812 | 11 |
| 12 Linthgebiet | 291 | 33,639 | 53,141 | 1 895,11 | – 58,21 | 4 783,22 | 47,034 | 10 | 63,301 | 14 |
| 13 Walenseetal | 237 | 33,654 | 54,000 | 1 417,63 | – 228,00 | 4 262,00 | 47,265 | 13 | 62,322 | 10 |
| 14 Rheintal | 751 | 33,595 | 53,996 | 5 300,94 | – 76,21 | 13 726,99 | 47,205 | 12 | 62,218 | 9 |
| Total | 2 629 | 33,539 | 53,663 | 17 748,94 | 149,54 | 47 363,41 | 47,066 | | 62,499 | |
| *Appenzell + St. Gallen* | | | | | | | | | | |
| (Somme) | | | | 23 051,89 | 1 223,06 | 63 736,86 | | | | |
| (Entre les régions) | | | | 419,53 | 207,27 | 562,94 | | | | |
| Total | 3 559 | 33,366 | 53,579 | 23 471,42 | 1 430,33 | 64 299,80 | 46,872 | | 62,274 | |

*Tableau 5.* **Largeur et hauteur du nez.**

*Résumé.*

On a utilisé l'analyse discriminante pour étudier comment la longueur maximale et la largeur maximale du crâne variaient d'une région à l'autre des cantons d'Appenzell et de Saint Gall.

La discrimination trouvée s'élève à:

$$X = 1{,}000\,000\,x - 0{,}880\,214\,y$$

où $x$ = longueur maximale du crâne – 140 mm
$y$ = largeur maximale du crâne – 140 mm.

Elle est significative à 1 $^0/_{00}$, c'est à dire qu'il y a moins d'une chance sur mille que ces régions soient identiques relativement à ces deux mesures.

L'efficacité de l'indice crânien par rapport à la meilleure discrimination s'élève à 95,6 %. Cet indice est donc pratiquement aussi efficace que le discriminant X.

La même analyse portant sur les grandeurs $x$ = largeur du nez et $y$ = hauteur du nez donne la discrimination

$$X = 1{,}000\,000\,x + 0{,}272\,070\,y.$$

Cette discrimination est également significative à 1 $^0/_{00}$. Par contre l'efficacité relative de l'indice nasal par rapport à la meilleure discrimination n'est plus que de 12 % ce qui signifie qu'il faut analyser 8 fois plus d'individus au moyen de l'indice nasal qu'au moyen de l'analyse discriminante pour obtenir la même information.

Nous tenons à remercier le professeur *O. Schlaginhaufen* d'avoir mis à notre disposition les fiches anthropométriques de son enquête portant sur l'ensemble des conscrits suisses des classes 1927 à 1932 et d'avoir suivi nos calculs avec une bienveillante attention.

*Summary.*

On the basis of anthropological material collected by Prof. *Schlaginhaufen* the discriminatory analysis of *R. A. Fisher* is compared to the well-known cranial index and nasal index. The efficiency of the cranial index compared with discriminatory analysis is 95.6 per cent, while the nasal index compared to the discriminatory analysis shows an efficiency of 12 per cent only.

*Zusammenfassung.*

Auf der Grundlage von anthropologischen Angaben, die uns Prof. *Schlaginhaufen* freundlicherweise zur Verfügung stellte, konnte das Trennverfahren von *R. A. Fisher* mit dem Schädelindex bzw. mit dem Nasenindex verglichen werden. Der Wirkungsgrad des Schädelindex verglichen mit dem Trennverfahren beträgt 95.6%, während er sich für den Nasenindex verglichen mit dem Trennverfahren nur auf 12% beläuft.

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# ON THE FACTORS INFLUENCING FERTILITY. A STUDY OF THE 670 MARRIAGES OF 531 PROSTITUTES

By KALEVI NIEMINEVA, Helsinki.

The role of the prostitute woman is one of the most problematic questions in human society presenting features that are cosmopolitan on the one hand and notably local on the other. Prostitutes have appeared in the midst of the community from the very dawn of civilisation. As material for research work they supply many interesting points of study. Psychologists and sociologists are mostly concerned with their characteristic inclinations and hereditary affections as well as with the cause that have driven women to indulge in this ungracious trade.

An important and unique objective for research are their eventual marriages, especially when considered from the standpoint of the prostitute's adaptability to society in her later phases of life. It is a generally wellknown fact that venereal disease (gonorrhoea) and criminal abortions that impair fertility even in this age of advanced medical science are very common among these women. For research work in general on the etiology of human sterility these marriages offer details that are clarifying and valuable also to the gynecologist. It is naturally quite a different matter and decisively of more importance what the general attitude of society is on questions pertaining to the fertility of prostitutes in matrimony, for instance when one considers *Kemp*'s observation that at least in Denmark 70 per cent of the prostitutes show mental deficiency. For data on the health and social aspect of prostitutes I refer to the work "Prevention of Prostitution" published in 1943 by the Committee for Social Questions at the League of Nations.

On perusing the literature I could not find a single publication that expressly treated the fertility of prostitutes in marriage, so that finding an opportunity of developing further *Wilen*'s earlier (1932) investigations in Finland on the wedlocks of prostitutes, I

considered the work expedient, all the more so as *Wilen* on the question of population went rather only half way. Naturally at that point of time he could not yet have made any observations on fertility from his material, as quite a considerable part of the marriages had only just then been contracted.

*Wilen*'s material comprised 6284 women that on evidence had been recorded by the Sanitary Bureau of the City of Helsinki as having in the period from June 1, 1908, to August 31, 1930 practised professional lewdness. It might be mentioned that regulated prostitution was abolished in Finland in 1907 and the surveillance of the prostitutes turned over from the Police to the Health Authorities. Sanitary Bureaus under the charge of physicians were then established in the cities and they had supervision over the prostitutes. Helsinki, the capital of Finland, was in 1907 a city of some 120 000 to 130 000 inhabitants, the population then doubling during the period that *Wilen*'s investigations covered. For the frequency of the marriages contracted amongst the prostitutes he took up in his work the women who had presented to the Sanitary Bureau their marriage licence in proof of their having married after the supervision began. Reports came in almost without exception from all the women that had contracted marriage, as they were exonerated from control when making the report. As marriage frequency per year and per thousand prostitutes *Wilen* gives the figure 31.8. For the same period the relative figure for all women over the age of 15, unmarried and divorced women as well as widows included, was in Finland 33.2. The only notable difference according to *Wilen* was that the frequency of the prostitutes' marriages fluctuated considerably within the various years, this apparently being due largely to external factors as for instance war time conditions.

*Wilen* had made note amongst other things also of the trade or profession of the men whom the prostitutes had married. He states his having received the impression that many of the prostitutes married well. His figures show that 7 per cent were in fairly good social position (officials and army officers, independent business men, artists, etc.), 22 per cent belonged to the middle class (artisans, clerks, foremen, non-commissioned army officers, etc.), and the remaining 71 per cent to a third group which for the most part was comprised of factory, agricultural and unskilled labourers and seamen. Some part of the facts brought forth by *Wilen* appears also in my own observations, so that I will not go any further into them now.

### *Material and results.*

I have taken for study the women that during the period from June 1, 1908 to December 31, 1930, came under the observation of the City of Helsinki Sanitary Bureau for prostitution, having admitted the fact themselves. This bureau has since [1943] been called the City of Helsinki Policlinic for Venereal Diseases and at the same time its original plan of work has also undergone change. In this connection I wish to express my thanks to the policlinic's Head Physician, Dr. *Yrjö Salminen*, for his kindness in placing the material at my disposal.

According to the Bureau's archives 769 of these women contracted marriage after having come under surveillance. In my material it must be considered a deficiency, though not for the chief purpose I have in view, but from the public and social standpoint, that I cannot present any of the circumstances which would show why in fact these prostitutes out of the great number contracted marriage. Were they perhaps better developed mentally? For this same reason I cannot later treat socio-eugenic questions with any trustworthiness.

I have then followed the subsequent destinies of these 769 women as recorded in the reliable archives of the Church and Civil Registers in the City of Helsinki and its vicinity. I have expressly paid special attention to the children born alive and to the eventual dissolution of the marriage due to death or divorce. For fertility investigations of this kind the children born dead are not in general taken into account, although information in part could be obtained on them. Moreover, as it hardly would have been feasible, I have not endeavoured to expose what is the part played by many possible external factors in the fertility of the marriages, although in many cases I found from the archives that one or the other of the pair had been confined for a longer period to prisons or insane asylum. The investigations[1]) were carried out in the course of the autumn of 1950. Thereby twenty years had elapsed since the youngest of the women had come under control, so that I consider the time sufficiently advanced for the post-examinations in regard to fertility. For the most part the age of those in the youngest group was over 45 years and they were thus approaching the end of their fertile period. The average age for the termination of fertility of normal women in Finland according to *Kauppinen* is $49.06 \pm 0.13$.

[1]) The search in the archives was undertaken for me by Miss *Maija Liukku*, a student of theology, to whom I express my thanks.

The post-examination revealed that six of the women had not been married at all, 112 or 14.6 per cent could not be located in the parishes recorded, nor in any others that we looked up. Moreover, 126 women or 16.4 per cent of the original material had moved away from Helsinki, in many cases right after the marriage, and not being attainable we could not always follow them up to date and therefore I cannot consider the information on them as satisfactory or acceptable. Nor did I accept for the final material defective data on childless marriages, where according to the archives the marriage had not lasted six years at least or where the wife had not at the moment of examination attained the age of 45 years. Beyond these periods which I have taken as limits changes in the fertility of the marriages are of so small moment that they do not affect the final results of my investigation. In his classic work *Siegel* appraises the chance of childbirth in sterile marriages after six years of wedded life to 1 per cent. On the other hand, according to the Official Statistics of Finland for the period investigated, the chance for women over 45 years of age to bear children was in Finland less than 1 per cent and, according to *Vara*, the percentage of women past 40 giving birth to their first child in the same period at the Helsinki Women's Clinic did not exceed ½ per cent of all primiparas. My aim in general has been not to take up any sterile marriages in my material except on fully trustworthy grounds, whereas marriages that bore children have all been approved.

My final material thus comprised 518 prostitutes, who in all had contracted 670 marriages. Of these women 110 had had when coming under control a total of 129 children, of which, however, 46 children had died before attaining one year's age. There were thus 24 illegitimate children to 100 women in my material. Of these children 15.6 to each 100 prostitutes were alive after the first year. They are not taken into account in my work, if not specially mentioned.

Of the number of marriages quoted 254 were dissolved by the death of either the wife or the husband. The duration of these marriages was on the average 11 years. The number of marriages dissolved by court was also great or 209. The duration of these marriages until the divorce was on the average 8.6 years. 67 prostitute women had contracted 70 fertile marriages. From these marriages there were in all 103 children born alive, or 149 per each 100 marriages contracted with a prostitute bearing children. From the above figures it can be perceived that 10.4 per cent of the marriages of the prostitutes in

my material were fertile. The biological fertility, which would include the children born alive or dead, as well as the miscarriages, would of course be somewhat greater. On the other hand we received for fertility the figures of 15.4 children born alive to 100 marriages contracted by a prostitute, or 19.9 live-born children to each 100 prostitutes. Taking into account also the illegitimate children, the figures are 34.6 and 43.7 respectively. The distribution of the whole number of cases on the years when the marriages were contracted and the ages of the women appear in Tables 1 and 2.

*Table 1.* Years when marriages were contracted.

| Year | 1910 | 1911–20 | 1921–30 | 1931–40 | 1941–50 |
|---|---|---|---|---|---|
| First marriage | 18 | 188 | 169 | 129 | 8 |
| Second marriage | 1 | 12 | 21 | 52 | 48 |
| Third marriage | – | – | 1 | 5 | 12 |
| Fourth marriage | – | – | – | – | 1 |

*Table 2.* Age when contracting marriage

| Age | I | | II | |
|---|---|---|---|---|
| –19 | 21 | 4.1 % | 22 | 3.3 % |
| 20–24 | 177 | 34.2 % | 180 | 27.0 % |
| 25–29 | 177 | 34.2 % | 191 | 28.6 % |
| 30–34 | 87 | 16.8 % | 122 | 18.3 % |
| 35–39 | 35 | 6.8 % | 67 | 10.1 % |
| 40– | 20 | 3.9 % | 85 | 12.7 % |
| Total | 517 | 100.0 % | 667 | 100.0 % |

I = First marriages, II = Total marriages.

The average age of the prostitutes when contracting their first marriage was 26.8 years and for all marriages contracted 29.4 years.

I have then divided the prostitutes into two groups on the basis whether they had live-born children (Group A) or not (Group B). The average age for those who contracted a first marriage and had children (Group A) was 24.2 years, and in Group B, 27.4 years. When studying the number of dissolved marriages in each group, it was found that the duration of the marriages dissolved by death was on the average 8.1 years in Group A and 11.4 years in Group B. The

corresponding figures for marriages dissolved by court were 8.5 and 9.5 years respectively.

The Sanitary Bureau's case histories contain the prostitutes' reports on the commencement of their sex life as well as information as to when the control authorities ascertained their having practised prostitution for the first time. The records also show that they had illegitimate children almost quite in proportion to the number of women in each group, i.e. in Group A 35.8 children, and in Group B 23.3 to each 100 women.

Table 3 presents data on the commencement of sex life in Group A and Group B.

*Table 3.* Age at commencement of sex life.

| Age | Under 15 years | 15–18 years | 19–21 years | 22–24 years | Over 24 years |
|---|---|---|---|---|---|
| Group A (Marriage fertile) | – | 43 | 15 | 2 | 4 |
| Group B (Marriage sterile) | 15 | 304 | 99 | 18 | 5 |
| Total | 15 | 347 | 114 | 20 | 9 |

The average age at the commencement of sex life is in Group A 18.5 years and in Group B 17.6 years. The intervening period between the time reported for the commencement of sex life and the prostitute's marriage is shown in the following Table 4, according to which the average duration of this period in Group A is 6.0 years and in Group B, 9.7 years.

*Table 4.* Period between commencement of sex life and marriage.

| Years | 0–3 | 4–6 | 7–9 | 10–12 | 13–15 | Over 15 |
|---|---|---|---|---|---|---|
| Group A |  |  |  | 8 |  |  |
| (Marriage fertile) | 17 | 20 | 16 | 3 | 7 | – |
| Group B (Marriage sterile) | 29 | 94 | 120 | 88 | 51 | 59 |
| Total | 46 | 114 | 136 | 91 | 58 | 59 |

Furthermore, I observed the period of time that had elapsed since the prostitute came under control of the Sanitary Bureau and

to the contracting of her marriage. This period is for those who bore children in their marriage 4.2 years and for the other group 6.3 years.

And finally, along with the results of the investigation it might still be noted that the birthplace of 98 of the women in my material was Helsinki, 80 originated from other towns in Finland with a population over 10 000, while 350 were from smaller towns or from rural districts. One could ask whether it was their moving into Helsinki that caused the young women to addict themselves to prostitution. Only in exceptional cases have foreign prostitutes appeared in Helsinki during the current century (*Wilen*). This warrants using the fertility values of the prostitutes obtained in this investigation as material for comparison with the average fertility values of the Finnish married women, that is, racial differences need not be taken into consideration.

### *Discussion.*

The result of our investigation showed 15.4 live-born children to each 100 marriages contracted by prostitutes or 19.9 live-born children to each 100 prostitutes who had contracted marriage. The figures as such do not give any clear picture of the general fertility of prostitutes, for these values must first be compared with the fertility values of all the marriages in Finland and above all in Helsinki during the period. Regrettably fully comparative data are not at my disposal; none the less the information given by the Official Statistics of Finland presents quite an accurate account in this respect. The differences between the results, moreover, are so obviously salient, that the final conclusions drawn from the comparison leave no room for doubt. To be sure the research made apart by the Official Statistics of Finland expressly on matrimonial fertility shows only the marital fertility in ten of the largest cities in Finland – Helsinki included – as from the year 1920, whereas a third of the marriages in my material were already contracted before that year (Table 1). In the official data there are included also quite recently contracted marriages diverting also in this respect from my own material. We know that the birth rate fluctuated; the general fertility in Finland in the 1920's continually fell, only to show a rising tendency in the 1930's. As to the City of Helsinki information (*Nieminen*) on the matrimonial fertility is at our disposal for the years 1938–39.

According to the Official Statistics there were born alive in

Helsinki in 1920 263 legitimate children to each 100 marriages (the corresponding figure for all the cities taken up in the Statistics being 299). The relative figure for the years 1938–39 is 266. This value is calculated from *Nieminen*'s work on the number of legitimate children yearly born alive. *On comparing the values thus received with my own results it can be observed off hand that the fertility in the marriages of the prostitutes examined is at most one tenth of the average fertility for Helsinki in that period.* In the figures for Helsinki for 1920 there are, as said, included all the marriages, also those recently contracted. On the other hand, only 10.4 per cent of the marriages in my material were fertile. According to the literature the percentage of sterile marriages all taken together fluctuates in Finland between 10 and 16 per cent (*Turunen*), or about the same figure as there are fertile marriages among the prostitutes.

In Finland an investigation has been made (*Paatero*) of the matrimonial fertility of women who have received an academic degree (M. D., B. A., Dipl. Eng., etc.). In point of time the investigation embraced the decades covered by my own work, thus offering interesting material for comparison. To be sure *Paatero's* material was not restricted solely to Helsinki, but at any rate to persons who spent an important phase of their life, the time they were in college and studying for a profession, within the sphere of its influence.

The average number of children to each 100 marriages of these professional women was 178 on the total number of marriages, 237 on marriages with a duration of 15–19 years, and 298 on marriages with a duration of 20–24 years. Of the marriages well nigh a half (44.4 per cent) had at the moment of investigation lasted over ten years. The divergence in the fertility values of the prostitutes who married is thus equally salient as in the foregoing instances.

What is the reason for the very low fertility rate in the marriages contracted by prostitutes?

It might be thought that this phenomenon could be explained at least in part by the factors which in general influence a woman's fertility, as for instance the age of the woman at the time of contracting marriage and the duration of the marriage. The importance of the woman's age has lately been emphasized amongst others by *Westman* in Sweden [1950] in his work on the etiology of sterility, while on the other hand *Turunen* in Finland stresses the decreasing influence that advancing age of the woman contracting marriage has on her fertility. Table 2 showed, however, that when taking the age limit

of the primiparas to be 30 years, we ascertained in our investigation of the first marriages of the prostitutes that 72.5 per cent of them had been at the moment of contracting marriage under this limit (all marriages taken into account 58.8 per cent) and the prostitutes who were over 40 years of age at the moment of contracting their first marriage were only 3.9 per cent. The average age when contracting first marriage was 26.8 years. According to the reports in the Official Statistics of Finland for the year 1920, in 82 per cent of the marriages the age of the woman at the moment of contracting marriage was under 30 years. In Finland the woman's age when contracting marriage had, however, risen during the period under investigation, there being in the years 1931–1940 78.4 per cent under 30 years. In *Paatero*'s investigation of academic women the average age when contracting marriage was 28.1 years. At the moment of contracting marriage the prostitutes had therefore been somewhat older than the normal average, but this difference in a biological sense is so small in my opinion that it cannot explain their low rate of fertility. On behalf of my opinion speaks the fact that the average age at marriage in *Paatero*'s material is higher than in my own, and yet his figures for fertility are of the Helsinki order.

Another important factor for fertility in marriage is the duration of the marriage. *Tietze* for instance has observed in planned first pregnancies that both the woman's age and the duration of marriage affected the time required for conception, the latter more significantly than the former. In my material a great number of the marriages were dissolved, and a considerable part dissolved by divorce. The average duration of the marriages dissolved by death was 11 years. It must be remarked that on the average the marriages where there were children did not last so long, their duration being 8.1 years. The average duration of the marriages dissolved by divorce was, however, 8.6 years, so that even in these marriages there should have been on the average 186 live-born children to each 100 marriages on the basis of the figures for fertility given in the Official Statistics. Naturally this average duration of marriage is not to be considered as identical with the period of wedded life together; this is especially the case where the prostitute's marriage terminated in divorce. Still, I would not think that the average duration of marriage in my material as a whole deviates so immensely from the normal that this would in any great degree lessen the rate of fertility, although this factor may be the cause of the loss of some 40 to 50 children per 100 marriages.

These general factors that influence matrimonial fertility do not therefore any more decisively apply to the prostitutes than they do to women in general. Consequently, they do not explain the prostitutes' low rate of fertility. The fundamental causes are most naturally to be sought in the prostitute women's past life and in the course of her trade. The factors which greatly impair her matrimonial fertility. and which are closely linked with her life and trade are chiefly gonorrhoea and criminal miscarriages. It must be remembered that the prostitutes under investigation lived their Sturm and Drang phase before the age of chemotherapeutics and antibiotics. The affectations of gonorrhoea and abortions with subsequent inflammations of adnexa and their sequels have been emphatically pointed out by all authoritative writers (*Vara*, *Vehaskari*, *Westman*) as the most decisive factors of sterility. We must also bear in mind the opinion shared by *Bernhard* that the misuse of tobacco and alcohol impairs a woman's fertility. For invariably narcotics and stimulants intimately form a part of the prostitute's daily life. The prostitutes in my material have in fact all without exception, according to the data in the archives at least once contracted a venereal disease, most of them more than once. The information in the archives of the possible miscarriages are so disconnected and unreliable that no accurate general picture could be had. Instead, the number of illegitimate children (21.2 per cent) supports the opinion that post-abortive and perhaps also puerperal inflammations play an important part amongst the prostitutes.

The above viewpoints are confirmed by mutually comparing the two groups of prostitutes, i.e. those who were fertile in marriage with those who were sterile. From my results it can be observed that the sex life of the prostitutes who had live-born children had on the average commenced a year later, the duration of sex life before marriage had on the average been four years shorter, while their period under surveillance of the Sanitary Bureau had been on the average two years shorter than that of those who were sterile in marriage. Consequently, the sterile prostitutes had been a prey to gonorrhoea and criminal miscarriages or both and in general to wasteful life earlier and longer than those prostitutes who later bore children.

A part of these factors, especially gonorrhoea, have certainly indirectly affected – although I cannot show this – the fertility of the prostitutes in marriage, especially as they have also lowered the fertility of the husbands who had contracted the disease. This irrespective

of the fact that *Wilen* observes a part of the women in my material to have contracted a favourable marriage from a social point of view.

As mentioned at the outset I lack information on the mental state of the prostitutes in my material. At any rate one can expect that in the marriages under investigation the desire to have children was weak or rather the birth of children was prevented. The prostitutes have indeed been in position to restrict birth of children more effectively than other folks. This cannot be shown by figures but I cannot consider it to be of great importance for the result of my investigations.

And finally I shall leave unanswered the question whether a very low rate of fertility in the marriages contracted by prostitutes be a happy solution of the problem from the viewpoint of population and in the eugenic sense. On the other hand I wish to emphasize that invariably one of the reasons for the unhappy outcome of these marriages is the childlessness of the home. Precaution to this effect is in fact an essential part in the measures taken against prostitution, even if underground. The social reforms of our day and the more appropriate medicines have been of great help in this work.

*Summary.*

The writer investigates the fertility of the 670 marriages contracted by 518 prostitute women of the City of Helsinki (capital of Finland) and obtains the figures of 15.4 live-born children to each 100 marriages or 19.9 live-born children to each 100 of the women. The figure of fertile marriages is 10.4 per cent. The average age of the prostitutes when contracting their first marriage was 26.8 years, that of those subsequently fertile 24.2 years and for the sterile 27.4 years. The duration of the marriages did not notably differ from the normal.

In the case of normal women the number of legitimate children born alive in the corresponding period and area was 263 to 266 per 100 marriages or about ten times greater fertility than that of the prostitutes.

*The prostitute women's low rate of fertility in marriage is to be understood as a natural consequence of the changes in the genital organs caused by gonorrhoea and criminal abortions or both and by wasteful live.* All the women in the material had at least once contracted venereal disease. Before marriage 21.2 per cent had had an illegitimate child.

It was ascertained by the investigation that the sex life of the prostitute women who were sterile in their marriage had on the average begun one year earlier and, before their marriage, had lasted four years longer than in the case of the women fertile in their marriage. Moreover the sterile women had been under surveillance for prostitution two years longer than the women who were fertile.

*Résumé.*

L'auteur examine la fécondité des 670 mariages contractés par 518 prostituées de Helsinki, ville capitale de la Finlande. Il reçoit le chiffre de 15,4 enfants nés vivants pour cent mariages ou 19,9 enfants nés vivants pour chaque centaine des prostituées. Le chiffre pour des mariages féconds est de 10,4 pour cent. L'âge moyen des prostituées contractant leur premier mariage était de 26,8 ans, de celles qui devenaient fécondes subséquemment 24,2 ans et celui des stériles 27,4 ans. La durée des mariages ne diffère pas notamment de celle des mariages normaux.

Pour des femmes normales la nombre des enfants légitimes et nés vivants dans la période et pour le lieu en question était de 263 à 266 sur 100 mariages; ainsi une fécondité d'environ dix fois plus grande que celle des prostituées.

*Le bas taux de fécondité des prostituées doit être considéré comme une conséquence naturelle des changes dans les organes génitaux causés par gonorrhée et des abortions criminelles, ou tous les deux, et par une vie prodigue.* Toutes les femmes dans notre matériel avaient contracté au moins une fois la maladie vénérienne. Avant leur mariage 21,2 pour cent avaient eu un enfant illégitime.

On a démontré par cette investigation que la vie sexuelle des femmes prostituées stériles dans leur mariage avait commencé un an plus tôt et avait duré avant le mariage quatre ans plus longtemps qu'au cas des femmes fécondes dans leur mariage. De plus les femmes stériles avaient été sous surveillance pour prostitution deux fois plus longtemps que les femmes fécondes.

*Zusammenfassung.*

Der Autor untersucht die Fruchtbarkeit von 670 Ehen von 518 weiblichen Prostituierten in Helsinki, der Hauptstadt Finnlands, und erhält die Zahl von 15,4 lebend geborenen Kindern bei je 100 Ehen bzw. die Zahl von 19,9 lebend geborenen Kindern bei je 100 Frauen.

Die Zahl der fruchtbaren Ehen ist 10,4 %. Das Durchschnittsalter der Prostituierten war bei ihrer ersten Eheschließung 26,8 Jahre, das der später fruchtbaren 24,2 Jahre und das der unfruchtbaren 27,4 Jahre. Die Dauer der betreffenden Ehen unterschied sich nicht bedeutend von der der normalen Ehen.

Bei normalen Frauen belief sich die Zahl der ehelichen, lebend geborenen Kinder in der fraglichen Periode und dem fraglichen Gebiet auf 263 bis 266 pro 100 Ehen, d.h. die Fruchtbarkeit war etwa zehnmal höher als bei den Prostituierten.

*Die niedrige Stufe der ehelichen Fruchtbarkeit bei den weiblichen Prostituierten ist als eine natürliche Folge der durch die Gonorrhöe und verbrecherische Abtreibungen oder diese beiden und durch zehrendes Leben in den Genitalien hervorgerufenen Änderungen zu betrachten.* Alle Frauen des Untersuchungsmaterials hatten sich wenigstens einmal eine Geschlechtskrankheit zugezogen. Vor der Ehe hatten 21,2 % ein uneheliches Kind gehabt.

Im Rahmen der Untersuchung wurde festgestellt, daß das Geschlechtsleben bei den weiblichen Prostituierten, die in ihrer Ehe unfruchtbar waren, im Durchschnitt ein Jahr früher begonnen und vor der Eheschließung vier Jahre länger gedauert hatte als bei den in ihrer Ehe fruchtbaren Frauen. Darüber hinaus hatten die unfruchtbaren Frauen zwei Jahre länger unter Prostituiertenüberwachung gestanden als die fruchtbaren.

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# Reviews

*Gerhard Kloos:* **Die Konstitutionslehre von Carl Gustav Carus mit besonderer Berücksichtigung seiner Physiognomik.** (Bibl. Psychiat. et Neur. Fasc. 90) S. Karger, Basle and New York 1951, 112 pp. sFr. 8.30.

There are few concepts in medicine, biology and psychology which have contributed more to confusion than the term constitution. Constitution is something everybody speaks of but, as far as the reviewer is aware of, nobody has yet been able to present as a workable concept. This is not surprising if, as most writers on this topic do, one wants to collect in one grip the integers of supposed constants of an ever changing animal, man or any other. If one wants just a philosophic solution, however, the problem does not exist. Since the rise of modern genetics there has been a trend to equal constitution and genotype. In fact the genotype is the only adequate translation into scientific language of the older term constitution if one wants a logic solution. It is quite another thing that this solution from a practical and especially clinical viewpoint comes out as next to worthless. One is liable to consider constitution as belonging to those concepts which are transmitted by the way of cultural inheritance. They are kept, very likely out of traditional and emotional grounds. One tries to change definitions to correspond with recent developments but with meager results, mostly because there was no adequate definition in the first place.

Much of the trouble comes from the fact that the term constitution was coined during a period when science was founded on assessments of values, the belief and personal experience of authorities and not so much on judgement of coincidence of facts. The search for some kind of biological constants which should characterize individuals or groups of individuals to be used for predictions of behaviour or prognosis is very old. Many systems have been developed and many more will come. A critical review of more recent literature on constitutional typology was given by *G. Dahlberg* in this journal (Acta Genet. et Statist. Med., Vol. I, Fasc. 2).

As no two individuals are exactly alike and continuously change from fertilization to death all these systems of classification are deemed to be more or less artificial. However, this does not mean that they necessarily are without value. As is typical for systems and theories which are not founded on solid facts about which general agreement can be reached the fight between different schools is a lot more emotional than rational.

The main point of controversy has always been the correlation between physique and psychic structure of the individual. Also recent developments in this field like the systems of *Kretschmer* and *Sheldon* show severe deficiencies if one wants to apply them in the clinic. They often fail in the individual case whereas they stand out as interesting attempts of classifying groups of people.

To anyone who is interested in the study of constitution in its different meanings or in the history of science the book by Dr. *Kloos* is recommended. The writings of the German physician and philosopher Carl Gustav Carus [1789–1869] has been subjected to a number of analyses by several authors. These, however, almost exclusively have been interested in purely philosophical and psychological topics. Now Dr. *Kloos* presents a synopsis of Carus' ideas about bio-medical problems. Also the history of the concept of constitution is brought up starting with the Chinese and old father Hippocrates. The presentation is good and critical,

only a non-German experiences some difficulties to digest a number of heavy sentences. The fact that the history of constitution inclusive of Carus and up to the present time, at least to the reviewer, largely seems like a history of confusion should of course shed no blame on Dr. *Kloos*. His book will remain a valuable contribution to the history of science. To include one little bit of criticism I do think that Dr. *Kloos* somewhat overestimates the influence of Carus on the development of the bio-medical sciences and psychology. No doubt his influence was great during the latter part of the 19th century and another couple of decades and with concentration to Germany. Naturally it is unfair to criticize Carus with present day scientific knowledge. His contribution is historical and as such impressive. However, I can't find much in his writings which would be very useful at our present level of bio-medical research. J. A. Böök (Uppsala).

*H. Hosemann:* **Das Lochkartensystem und einige wichtige statistische Resultate auf gynäkologisch-geburtshilflichem Gebiet. – Fortschritte der Geburtshilfe und Gynäkologie.** Vol. 2. S. Karger AG, Basel und New York 1951. 149 S., 25 Abb. sFr. 18.70.

In der vorliegenden Arbeit wird die sogenannte Lochkartenmethode und ihre Anwendbarkeit für medizinische Arbeiten dargestellt. Nach Angabe ist die Lochkartenmethode im Anschluß an die Volkszählung 1880 in den Vereinigten Staaten erfunden worden. Die Bearbeitung des Materiales dieser Volkszählung, mit der Hand vorgenommen, nahm nämlich 7 Jahre in Anspruch, und das Ergebnis war deshalb, als es veröffentlicht wurde, veraltet und daher zum großen Teile wertlos. Im Zusammenhang hiermit arbeitete Hermann Hollerith, ein Sohn eines deutschen Einwanderers, ein mechanisches Verfahren aus, welches seitdem beträchtlich verbessert worden ist. Zur Zeit gibt es zwei Systeme, nämlich Hollerith und Powers. Beide Firmen haben Filialen in den meisten Kulturländern. Hollerithmaschinen, über welche die I.B.M. (International Business Machines Corporation) verfügt, kann man nur mieten. Powersmaschinen kann man sowohl mieten als auch kaufen. Natürlich kann man im allgemeinen bei beiden Firmen gegen entsprechende Bezahlung Bearbeitungen ausgeführt bekommen.

Die Arbeit gibt eine Darstellung über die Anlage der Lochkarte, die Kodifizierung der Angaben, welche statistisch behandelt werden sollen, das Einstanzen der Angaben auf die Karte, sowie die Möglichkeiten der Sortierungsmaschine, einfache oder kombinierte Angaben zu zählen.

Die Darlegung ist klar und leicht faßbar und die Anweisungen, welche der Verfasser bei der Planlegung von Lochkartenbearbeitung wissenschaftlichen Materiales gibt, gründen sich auf langjährige Erfahrung. Der Verfasser belegt die vielseitige Verwendung der Lochkartenmethode, in dem er in großen Zügen die Bearbeitung von Material über 26 000 Geburten darstellt. Er erwähnt daß die Bearbeitung des Materiales eine Zeit von 5 Jahren in Anspruch nahm, aber 500 Jahre gefordert haben würde, wenn die Bearbeitung mit der Hand geschehen wäre. Der Verfasser ist mit vollem Recht der Ansicht, daß sie in bedeutend größerer Ausdehnung angewendet werden sollte, als es jetzt der Fall ist.

Ob man nun Maschinen kauft oder mietet, stellt sich die Bearbeitung doch ziemlich teuer. Heutzutage ist ja der Lohn für Mädchen höher geworden. Früher bekam man sie so gut wie umsonst. Wie die Dinge nun liegen, kann man sagen, daß der Gewinn durch Maschinenbearbeitung hauptsächlich darauf beruht, daß man

die Bearbeitung schneller erledigt erhält als durch Handbearbeitung. Wie viel man finanziell bei der Maschinenbearbeitung gewinnt, hängt natürlich davon ab, in welchem Maße man die Maschinen ausnützen kann. Für ein einzelnes Institut wird es in der Regel allzu teuer. Um die Maschinen voll ausnützen zu können, brauchte man eine zentrale Anstalt, welche wissenschaftliches Material bearbeitet. Man sollte eigentlich an jeder Universität ein solches Institut für medizinische Statistik haben. Hiermit wäre der Vorteil verbunden, daß man auch die Sachkenntnis besäße, welche für die statistische Bearbeitung von wissenschaftlichem Material erforderlich ist. Vielleicht wäre es angebracht, daß die statistischen Universitätsinstitute sich einer solchen Bearbeitung annehmen würden.

Am Staatlichen Rassenbiologischen Institut in Uppsala haben wir seit langem eine solche Tätigkeit ausgeübt. Diese fordert, daß man sich die Mühe macht, sich mit verschiedenen medizinisch-statistischen Problemen vertraut zu machen, um bei der Bearbeitung Ratschläge zu erteilen. Es muß hervorgehoben werden, daß die Tabellen, welche man aus den Maschinen erhält, weiter bearbeitet werden müssen, indem man die Berechnung verschiedener statistischer Charakteristika ausführt, welche man benötigt. Gunnar Dahlberg (Uppsala).

*William L. Doyle*, *Hans Ris*, *Franz Schrader* and *C. Leonard Huskins*: **Symposium on Cytology.** Michigan State College Press. East Lansing, Mich. 1951. 69 pp. $ 1.50.

This booklet contains four papers which were presented at a Symposium on General Cytology held in the spring of 1950 at Michigan State College in East Lansing. The president of this symposium, Dr. G. B. Wilson, of Michigan State College, is to be commended for having brought together these competent scientists who all have approached central cytologic problems from different angles.

The papers are not primarily directed to specialists in the field of cytology. As the editor states in the introduction they were rather directed at bringing to the attention of biologists in other fields some of the major problems, concepts, and directions in the field of cytology. As such they are whole-heartedly recommended.

Dr. Doyle, of the University of Chicago, presents a paper on cytochemical determination of phosphatases. Among recent developments he emphasizes the discovery of the specificity of enzymes. The fact that specificity and concentration of enzymes determine the activity helps explain that many different chemical reactions can go on simultaneously within the cell without interference. One agrees with Dr. Doyle when he states that this is one of the most important findings in physiology so far. The discussion of the difficulties involved in the determination of phosphatases in cells and tissues is very informative and gives an excellent background for the interpretation of experimental results.

Dr. Ris, of the University of Wisconsin, discusses the chemical analysis of chromosomes. A remarkable advance has been made during the last 15 years. This has been possible mainly due to the development of new methods. The quantitative studies are just beginning. It would appear that we have got a few steps further and are approaching the answer to the old question: "What is a gene?" Evidence has accumulated that pentose nucleic acids are closely related to the genes and very likely responsible for the remarkable stability of these structures. On the other hand it is likely that the desoxy-pentose nucleic acids are responsible for its physiological changes.

Dr. Schrader, of Columbia University, discusses the forces responsible for movements of chromosomes during mitosis. After a critical review of the two prevalent hypotheses according to which the mitotic spindle is regarded either as a tactoid or, according to the other, as a chain of proteins, he concludes that as yet none of them is able to join all observed facts into an understandable pattern.

Dr. Huskins, of the University of Wisconsin, has given his paper the title "Science, Cytology and Society". It is very interesting to read the views of this outstanding cytologist and geneticist on science and education in general.

It is to be hoped that these papers which give comprehensive reviews of some pertinent problems in current cytological research will be read by everyone interested in fundamental biological problems. Jan A. Böök (Uppsala).

*Luigi Gedda:* **Studio dei Gemelli.** Edizioni Orizzonte Medico, Roma 1951. Lire 15 000.—.

Bekanntlich stellt die Zwillingsforschung einen wichtigen Zweig der Genetik dar. Die Unterschiede zwischen eineiigen Zwillingen sind durch Milieufaktoren bedingt. Die Unterschiede zwischen zweieiigen Zwillingen sind sowohl durch Milieu-, wie durch Erbfaktoren bedingt. Deshalb bedient man sich der Untersuchungen von diesen verschiedenen Arten von Zwillingen um festzustellen, welche Rolle das Erbe, respektive das Milieu spielen. Doch muß darauf hingewiesen werden, daß zur Milieuwirkung auch intra-uterine Verschiedenheiten gehören. Betreffend der Erbwirkung hat man vermutet, daß sogenannte genotypische Asymmetrien Verschiedenheiten zwischen Eineizwillingen bewirken würden. Selbst wenn dies der Fall sein würde, ist es sicherlich selten. Auf Grund der großen Bedeutung, welche die Zwillingsuntersuchungen für die Genetik besitzen, sind eine große Anzahl von Untersuchungen durchgeführt worden.

In der vorliegenden Arbeit wird eine ausführliche Übersicht über die Literatur auf diesem Gebiete gegeben. Der Verfasser, der italienische Genetiker Luigi Gedda, hat selbst auf verschiedenen Gebieten eigenes Material gesammelt, über welches in dem Buche Rechenschaft abgelegt wird. Es ist ein sehr umfassendes Werk von über 1000 Seiten mit einer einzigartigen typographischen Aussteuer und einem ausgezeichneten Illustrationsmaterial, besonders Farbphotographien von Geddas eigenen Untersuchungen. Das Werk dürfte als Referentbuch für die Zwillingsforschung der Humangenetik sehr willkommen sein. Der Preis ist im Verhältnis zum Umfang und Wert der Arbeit nicht hoch, um so mehr als die Arbeit auch eine Darstellung dessen enthält, was man von Zwillingsgeburten und deren verschiedenen Problemen weiß.

Es ist schade, daß die Arbeit in Italienisch geschrieben ist und deshalb nur einem kleineren Publikum zugänglich. Es wäre vorteilhafter gewesen, wenn sie in Englisch geschrieben worden wäre. Bei Bedarf einer einzelnen Aufklärung ist es sicher möglich, diese trotz der Sprachschwierigkeiten zu erhalten. Beinahe jeder Wissenschaftler kann eben mit wenig Arbeit geringere Stücke Italienisch verstehen. Der Referent, welcher selbst zu diesem Typ von Wissenschaftlern gehört, hat deshalb nicht die ganze Arbeit lesen können, sondern sich mit Stichproben begnügt, natürlich besonders an den Punkten, wo er selbst referiert ist. Diese Stichproben haben jedoch gezeigt, daß es sich um sehr zufriedenstellende Literaturübersichten handelt. Gunnar Dahlberg (Uppsala).

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